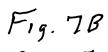
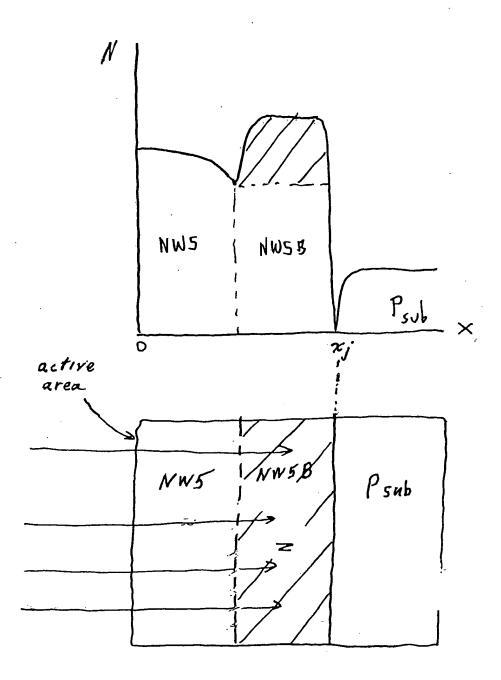
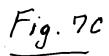


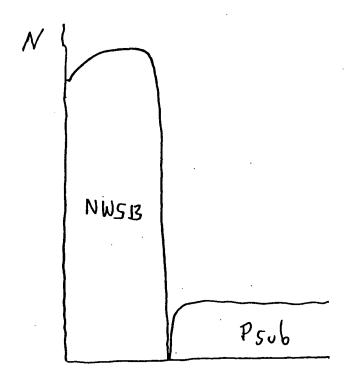
Prior Art

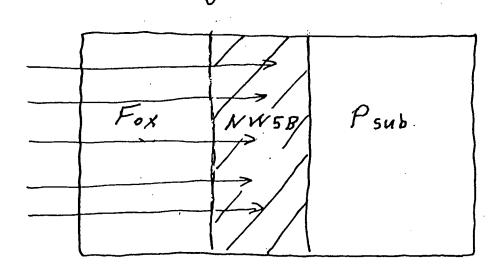
Prior Art Fig. 7A Nwell Psub γ_j Ō Psub













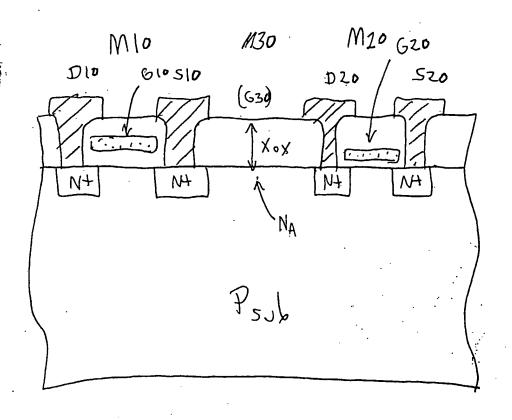
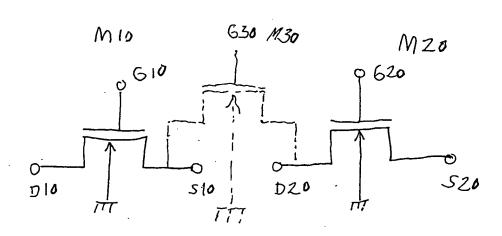
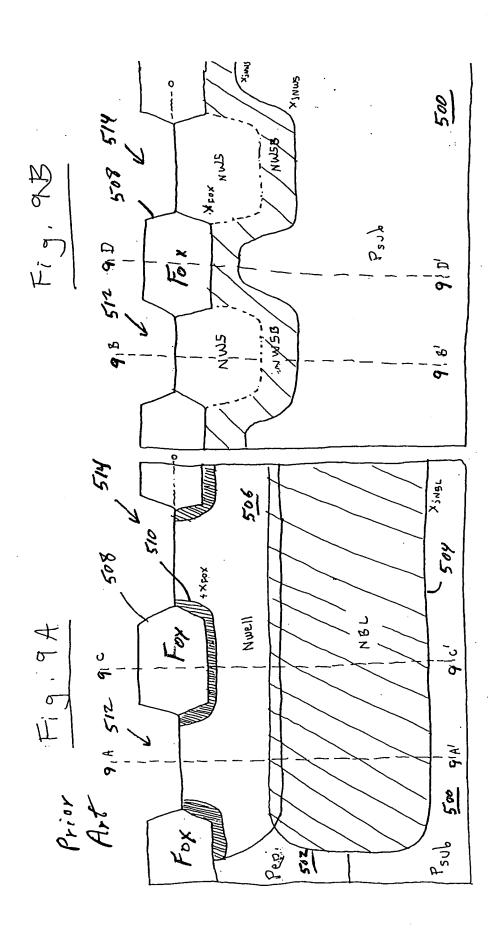
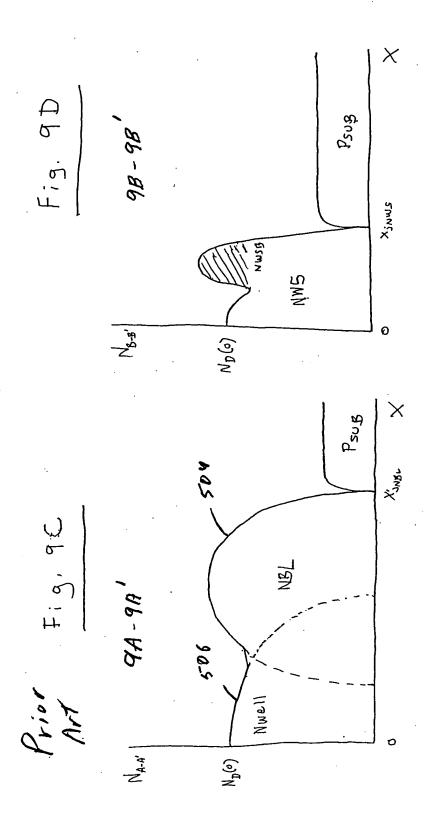
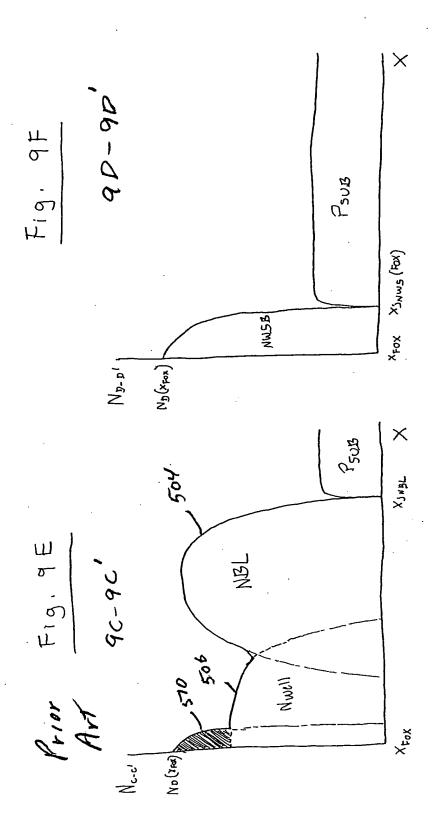


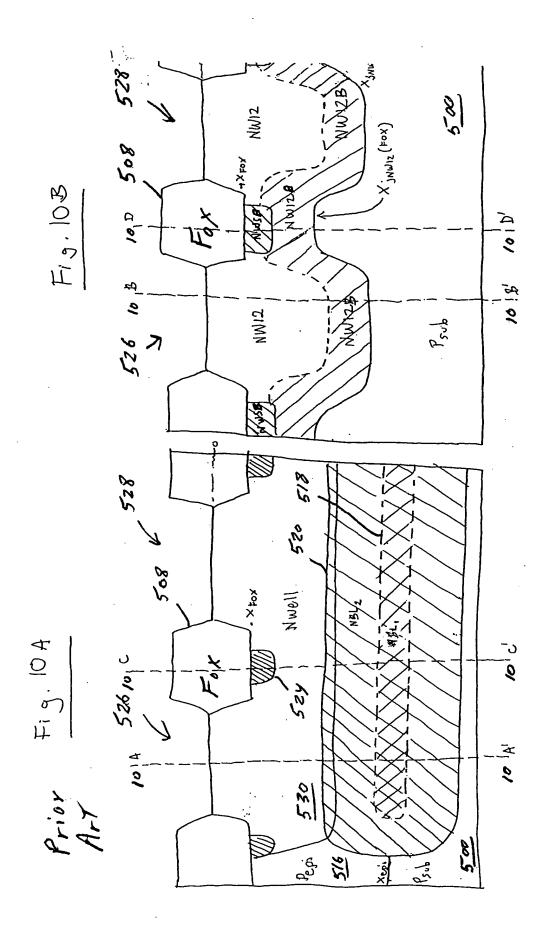
Fig. 8B

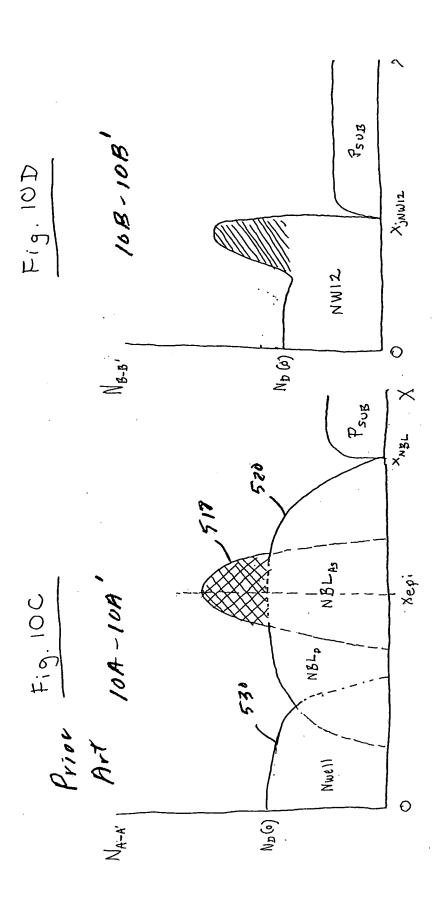


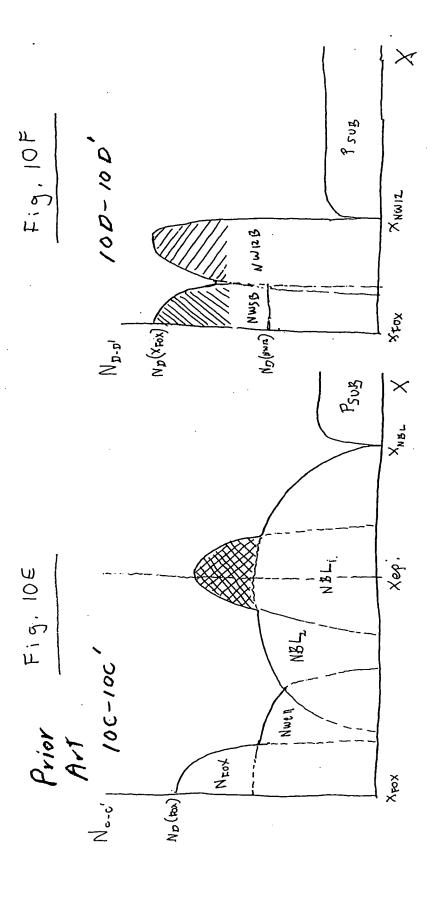


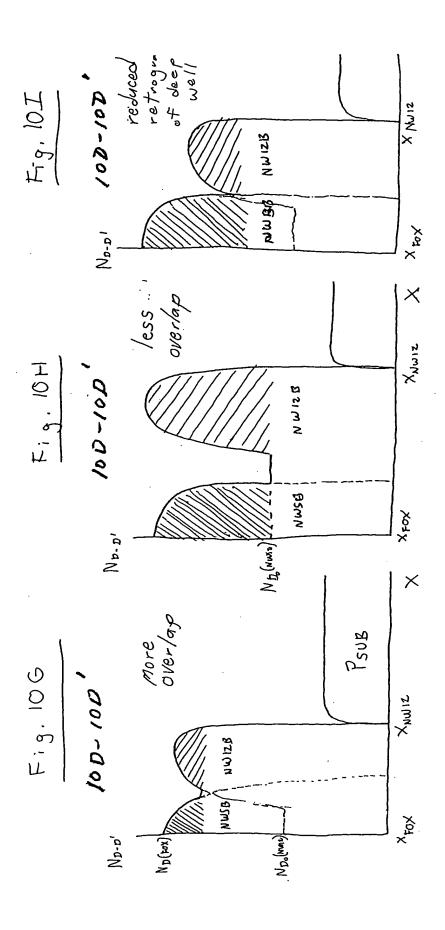


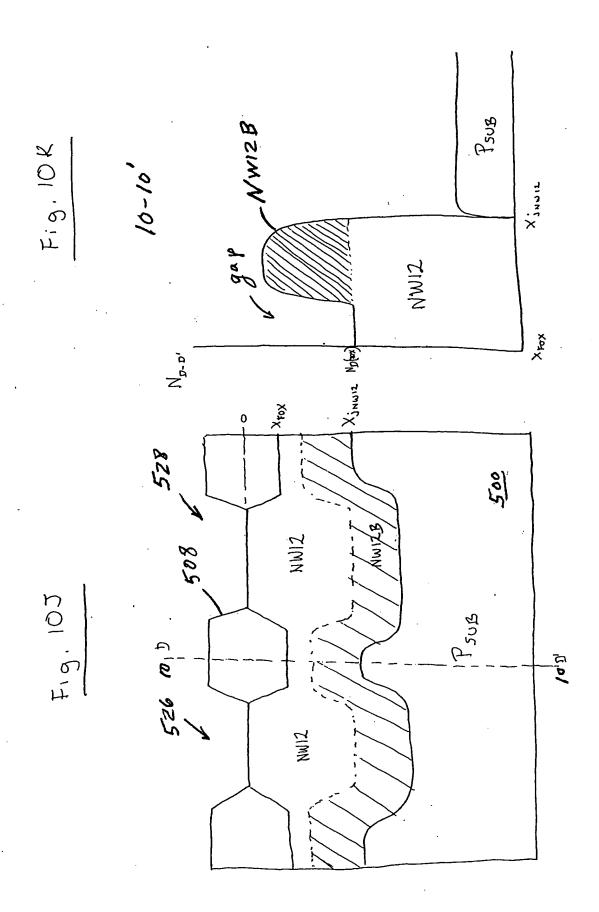


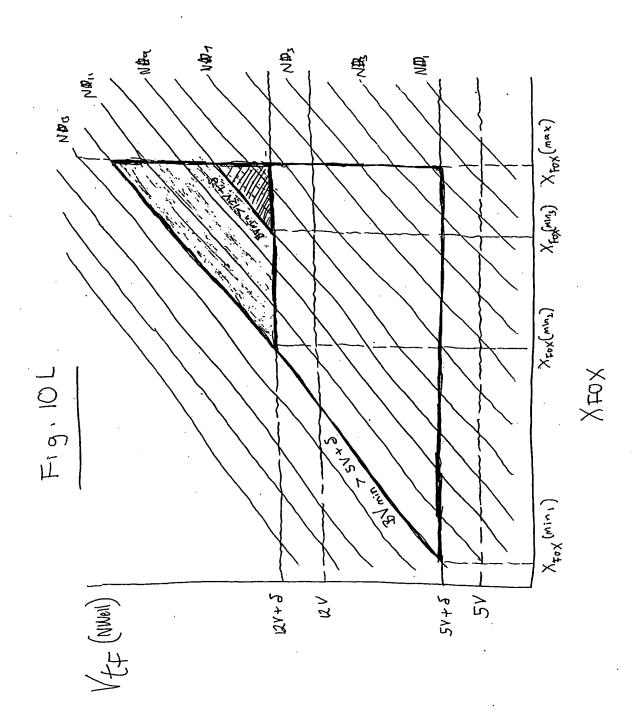


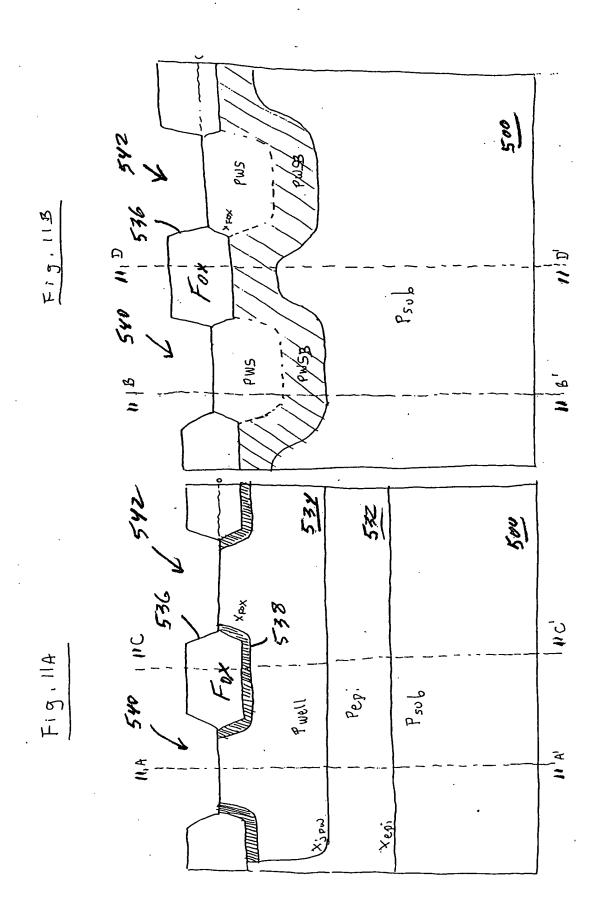


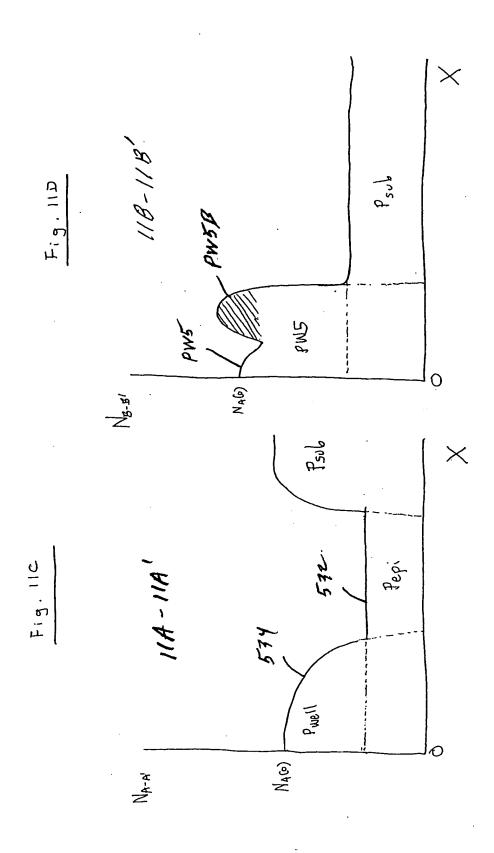


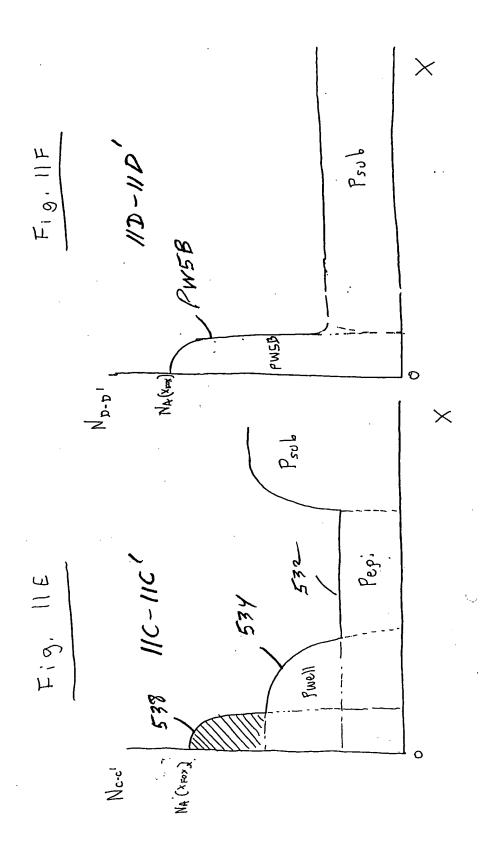


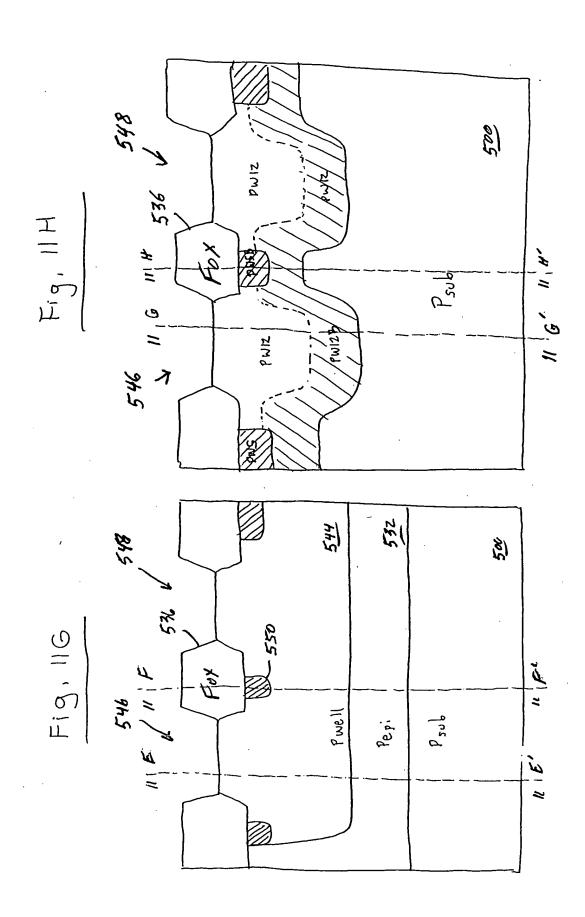


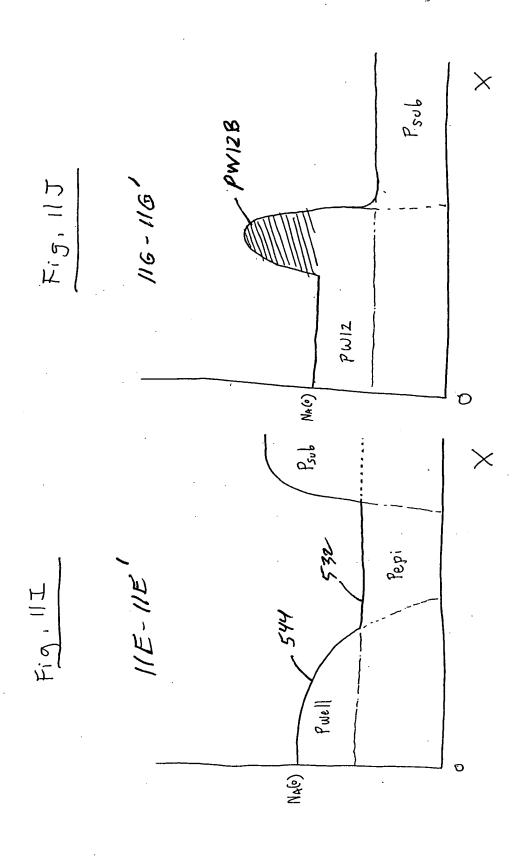


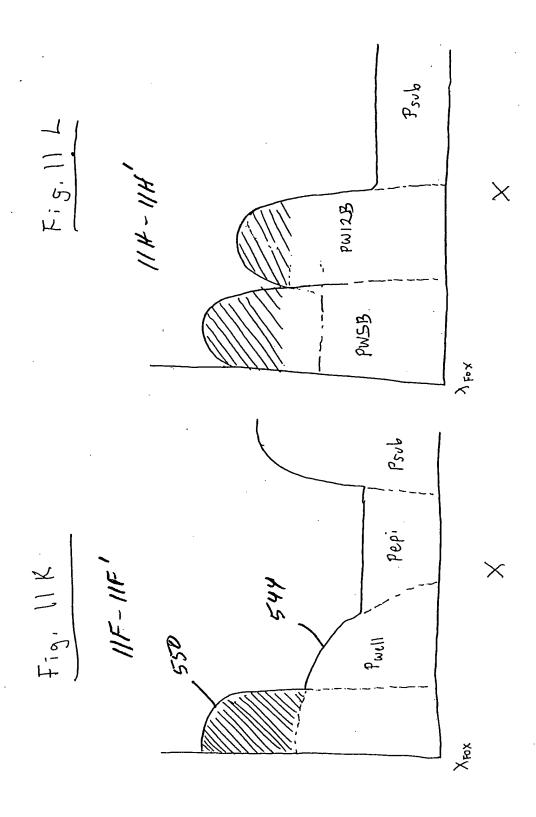


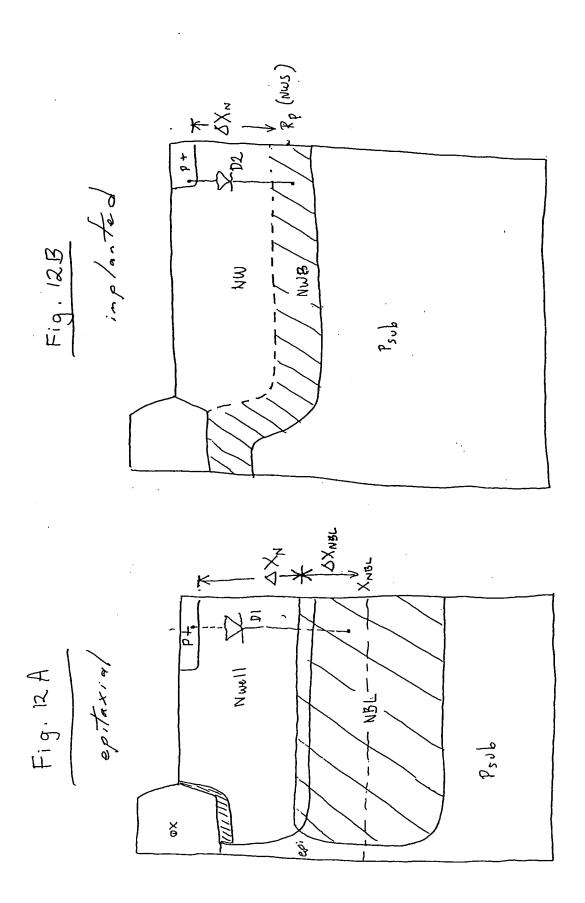


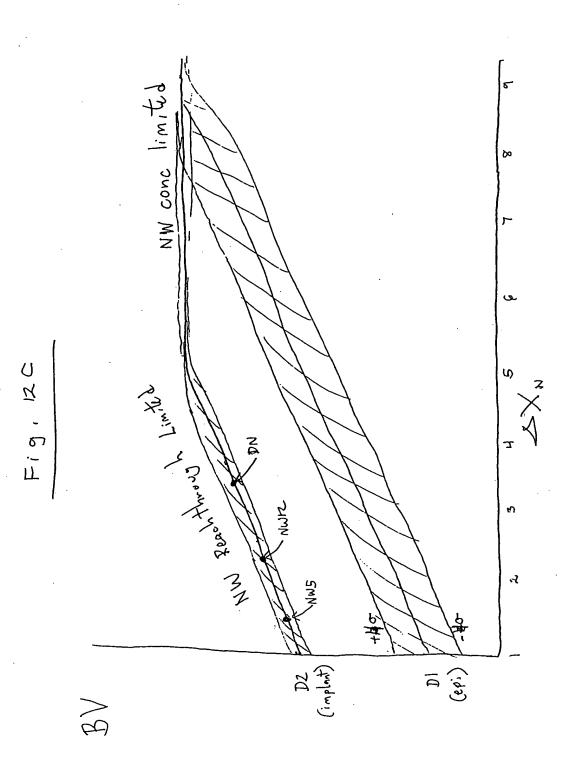


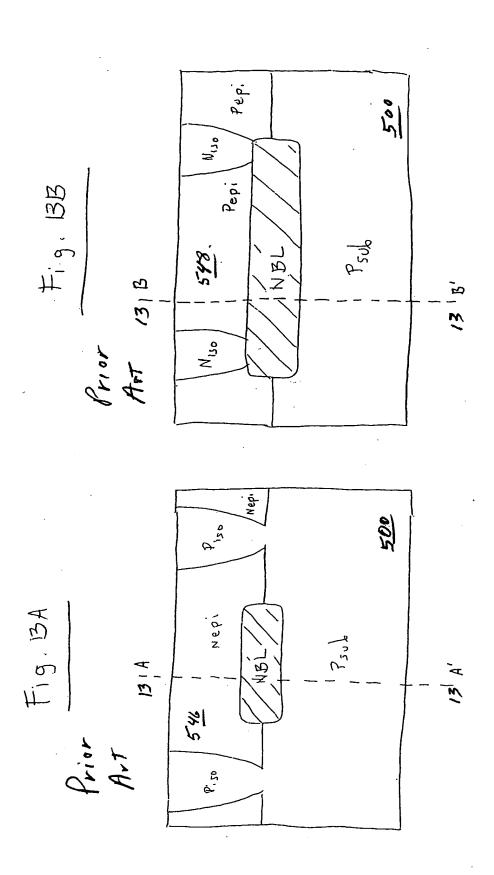


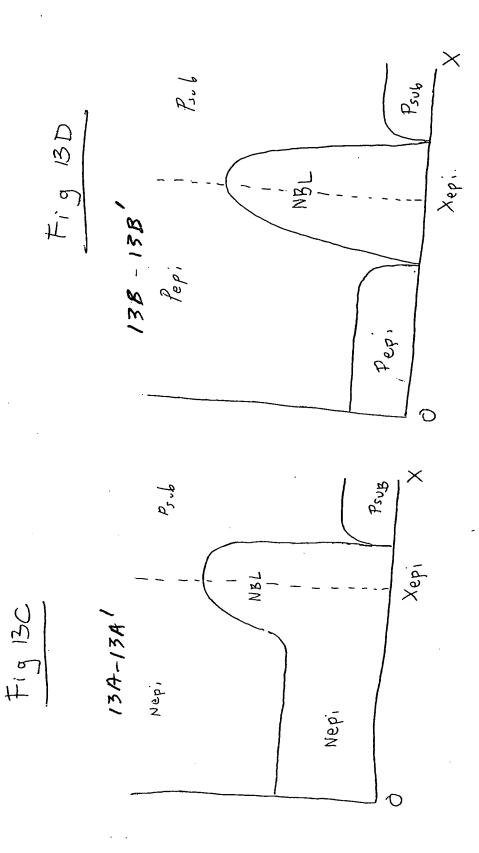


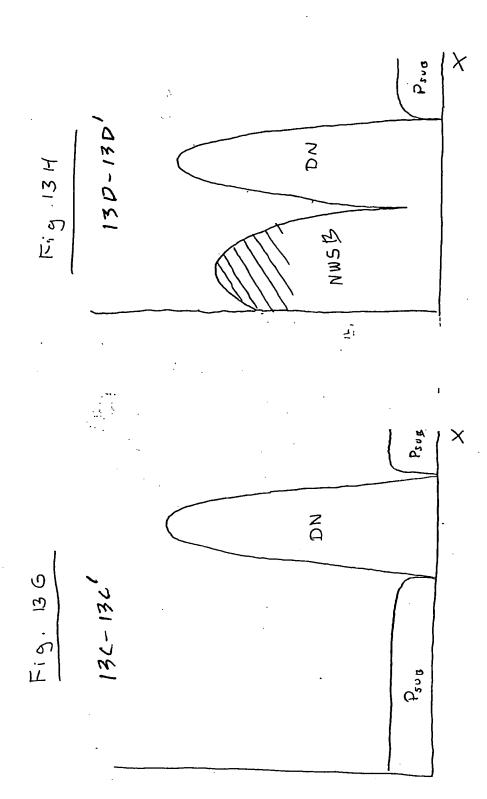


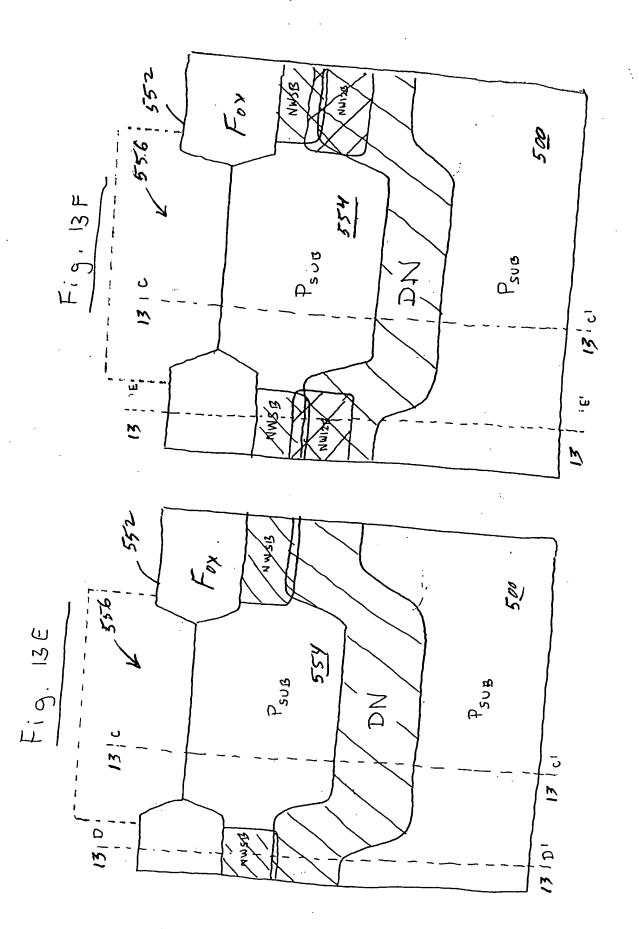


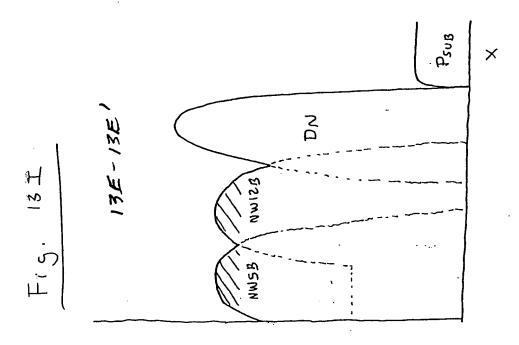












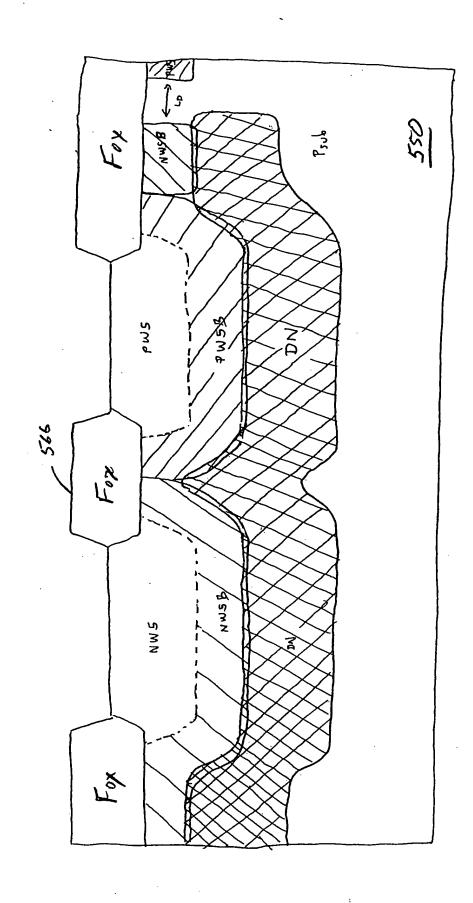


Fig 14A

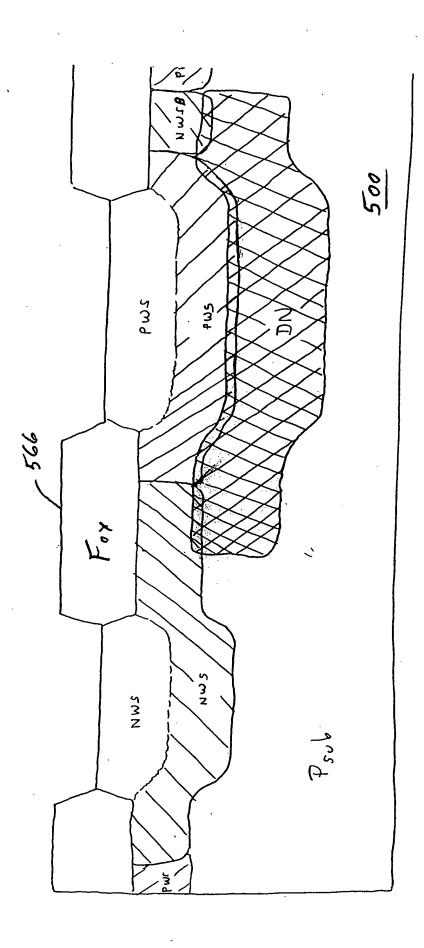


Fig. 14B

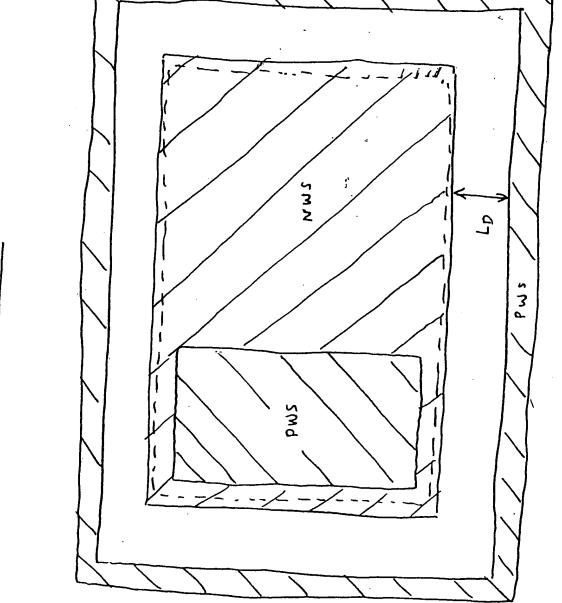


Fig. 14 C

Fig. IHE

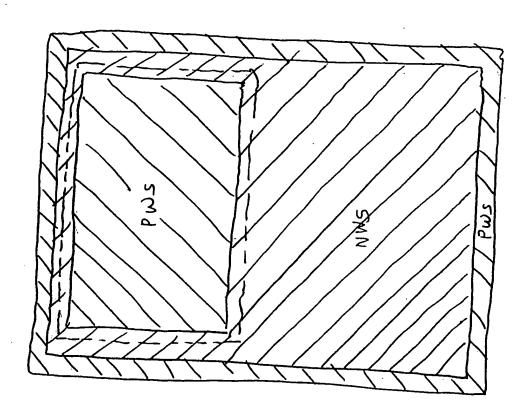
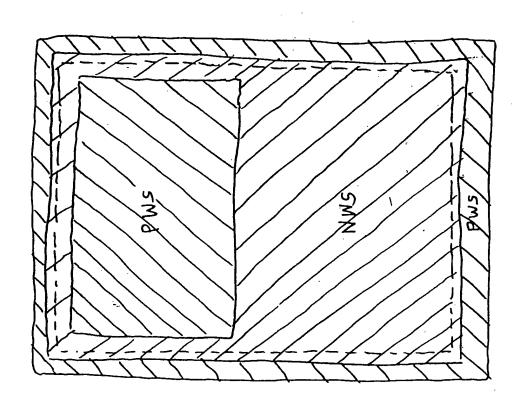
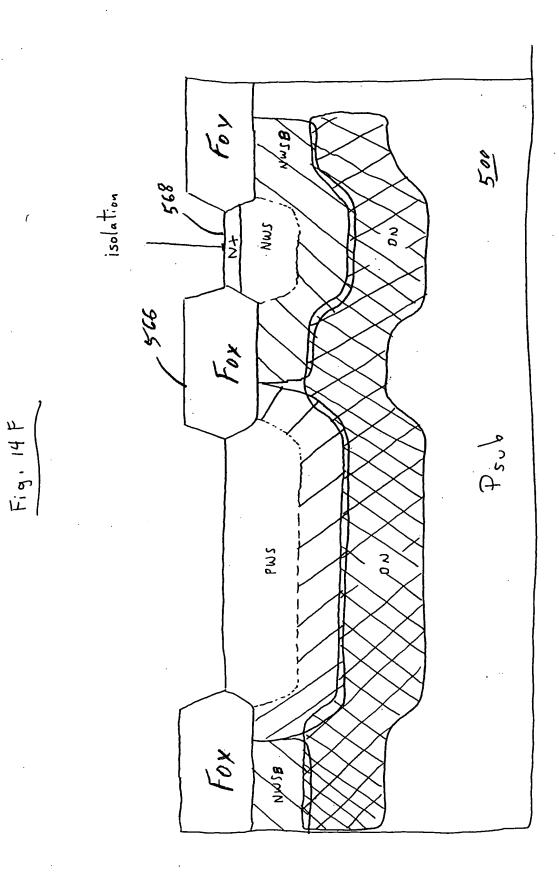
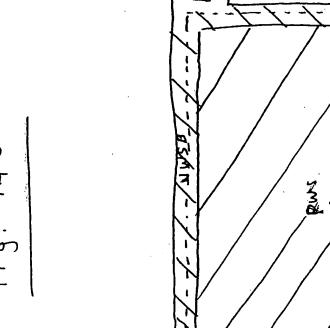


Fig 14D

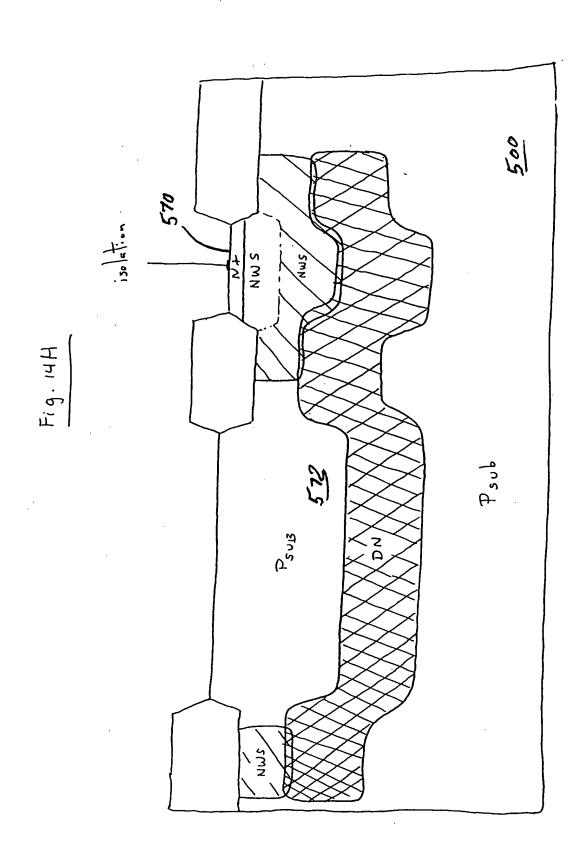






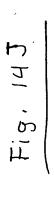
283

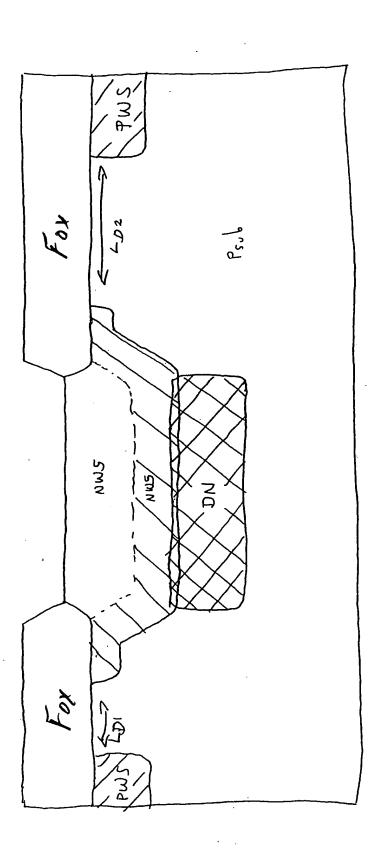
Fig. 146

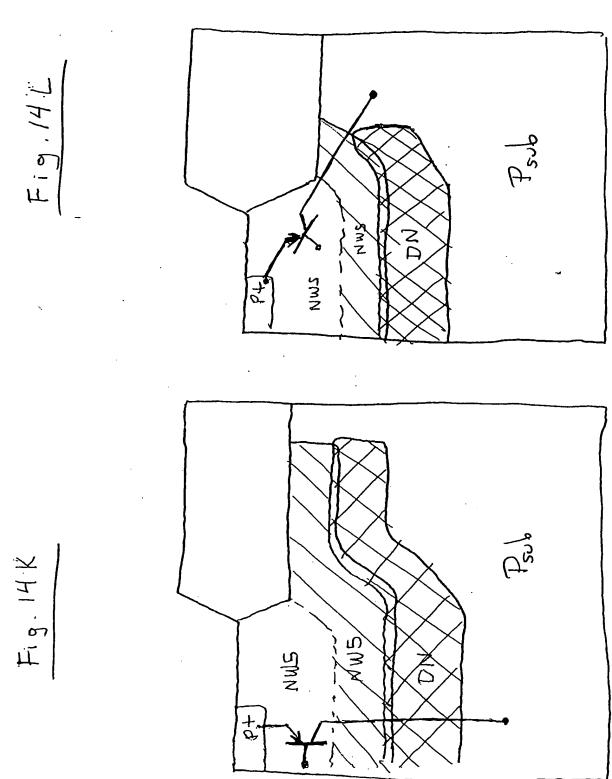


200 ص ج 2 W S Fox

Fig. 14I.

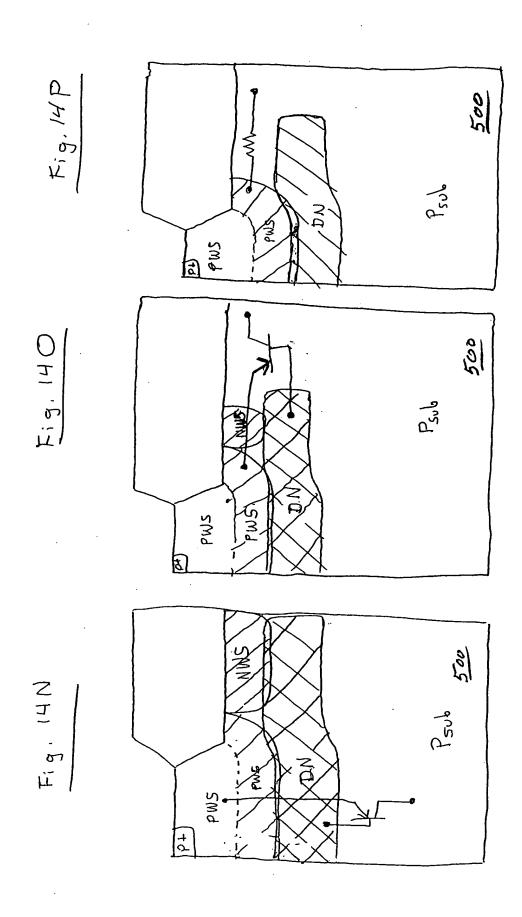






200 7,29 PWS

F. g. 14.KM



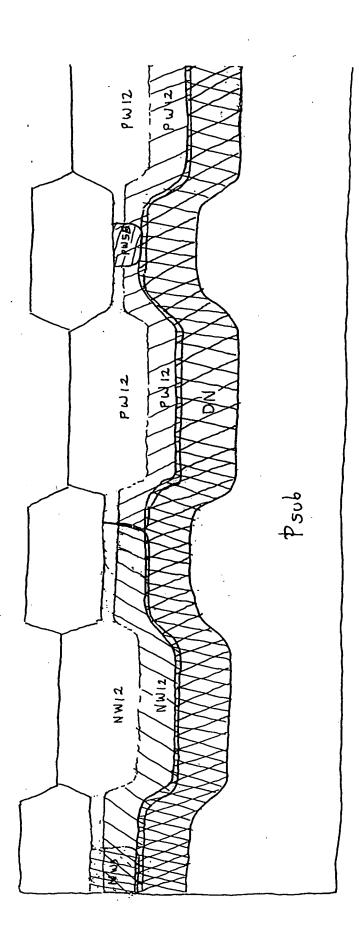
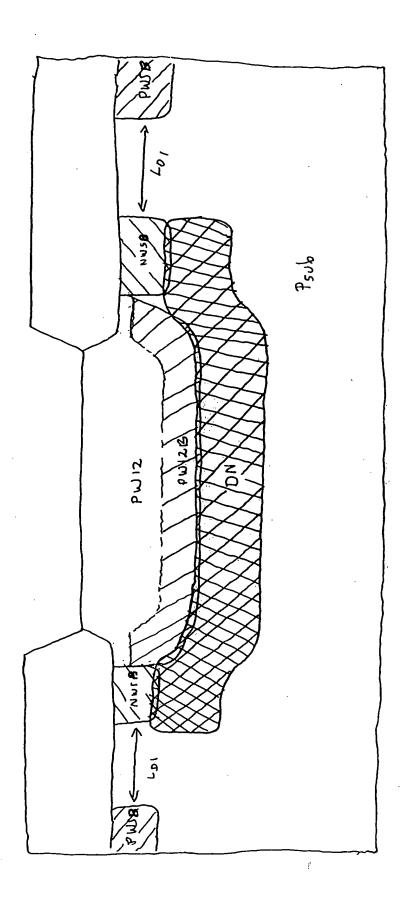


Fig. 6A



Fig, 15B

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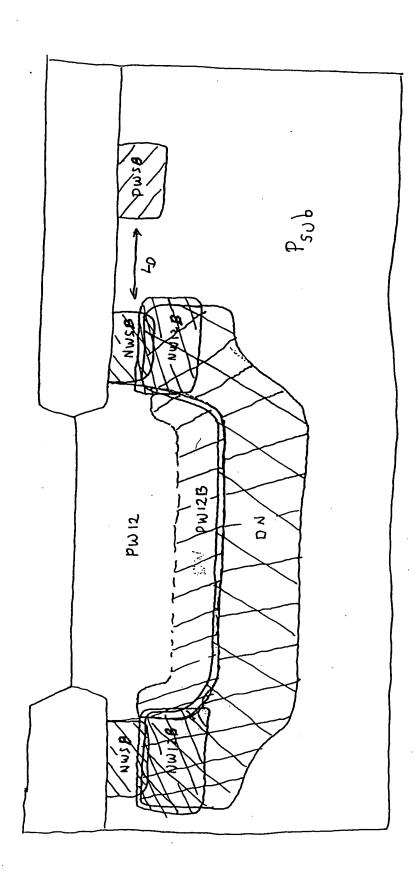


Fig. 15C

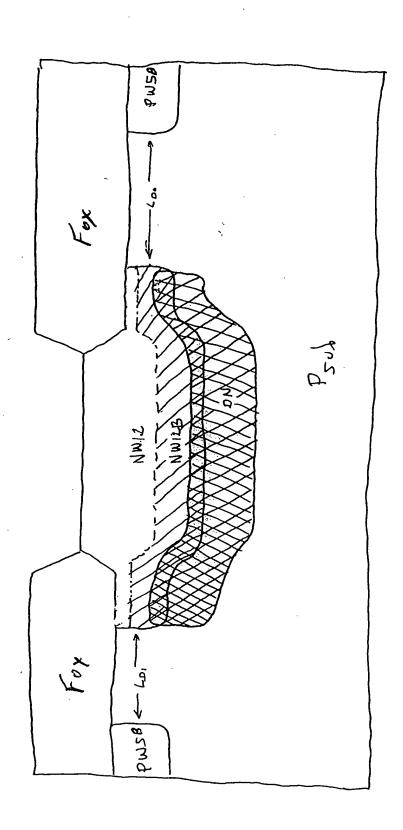
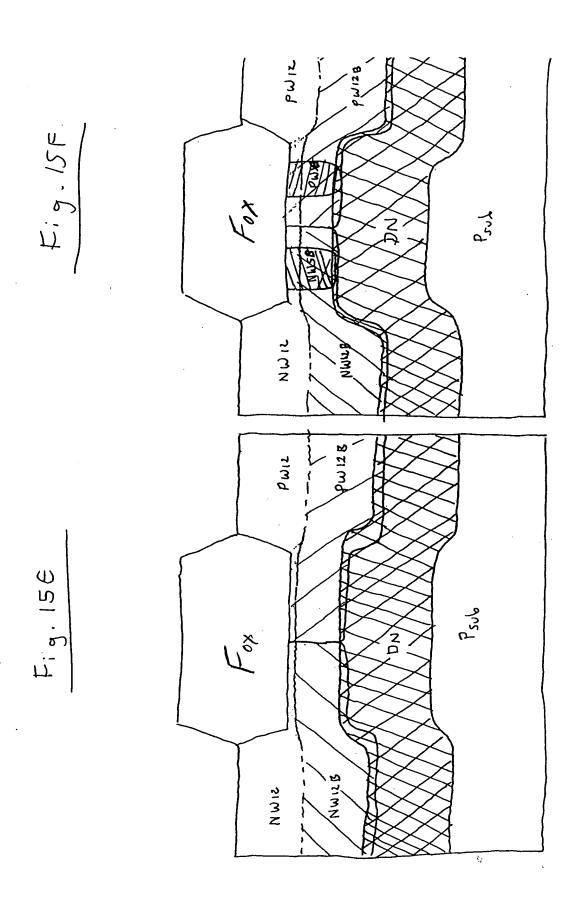


Fig. 151



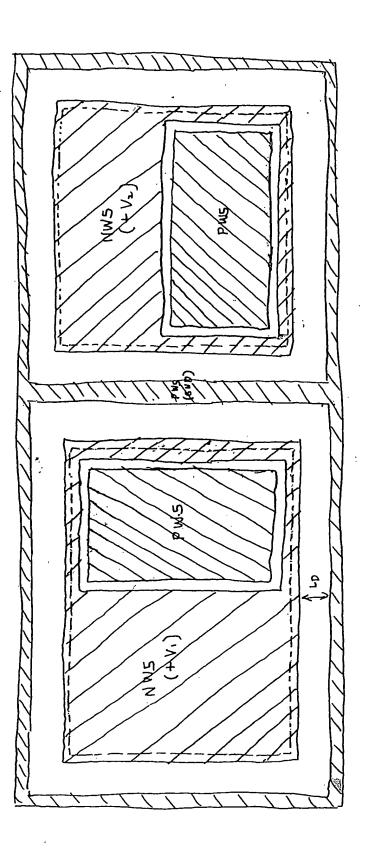
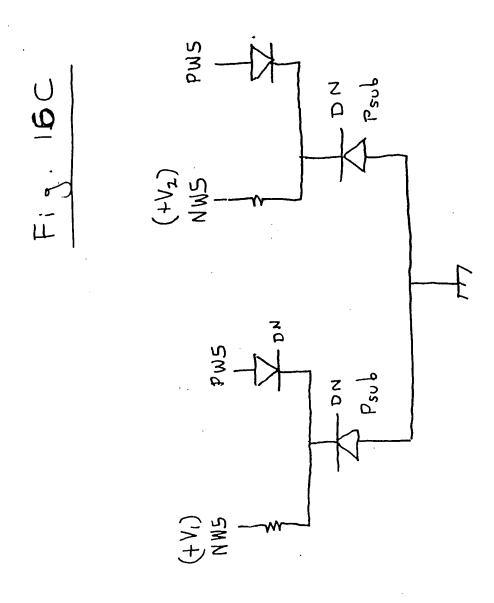


Fig. 16.8



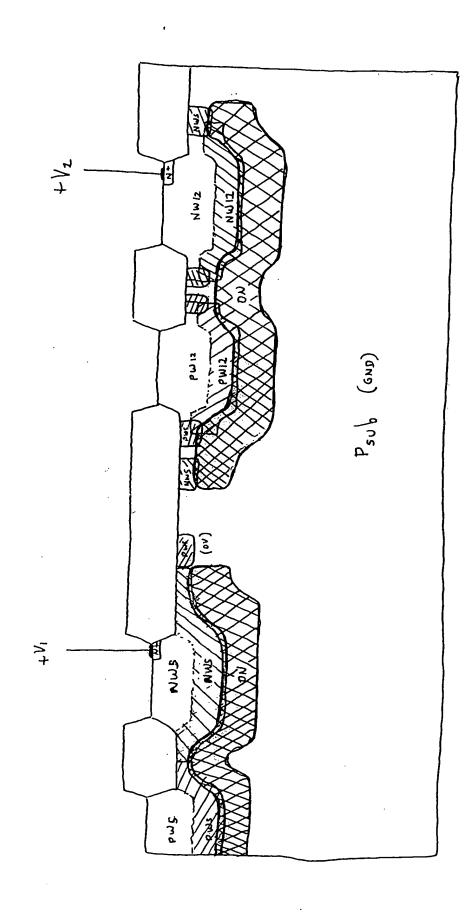
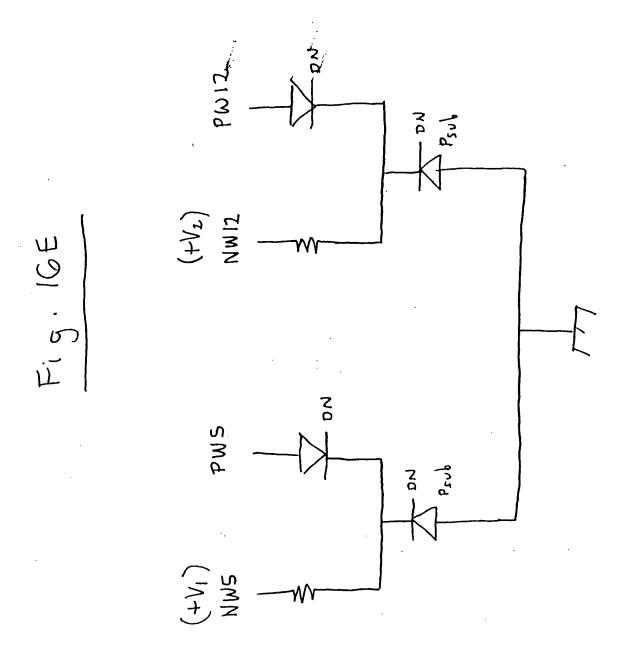
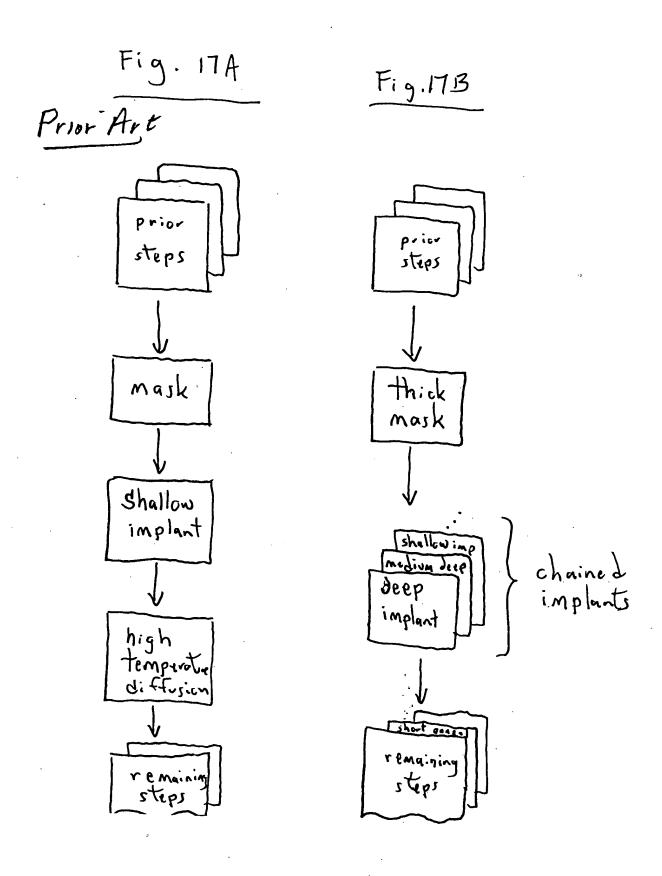


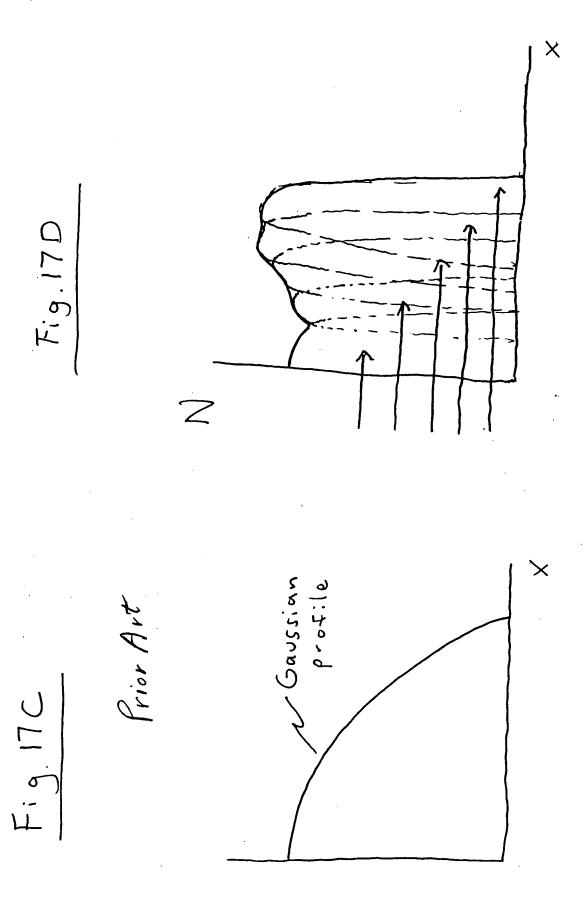
Fig. 16D



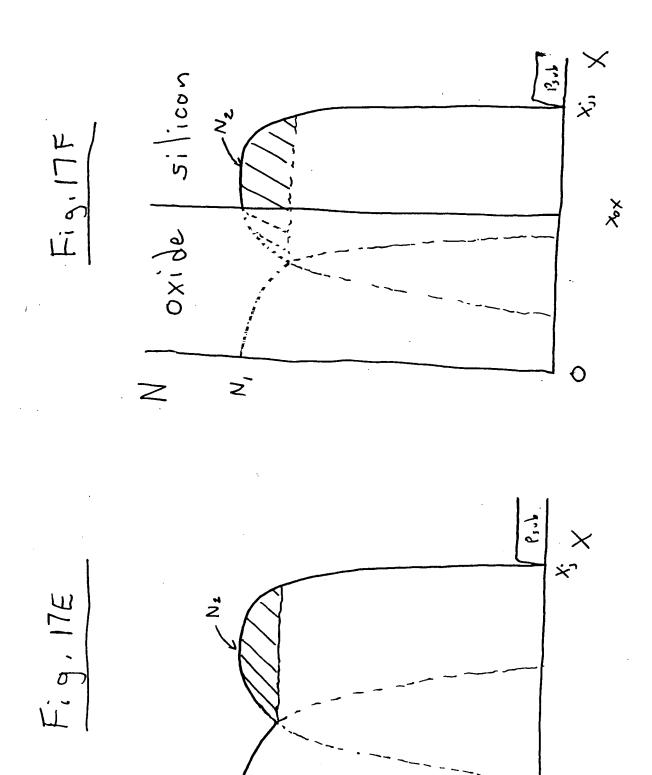
PW12 NW12

Fig. 16 F

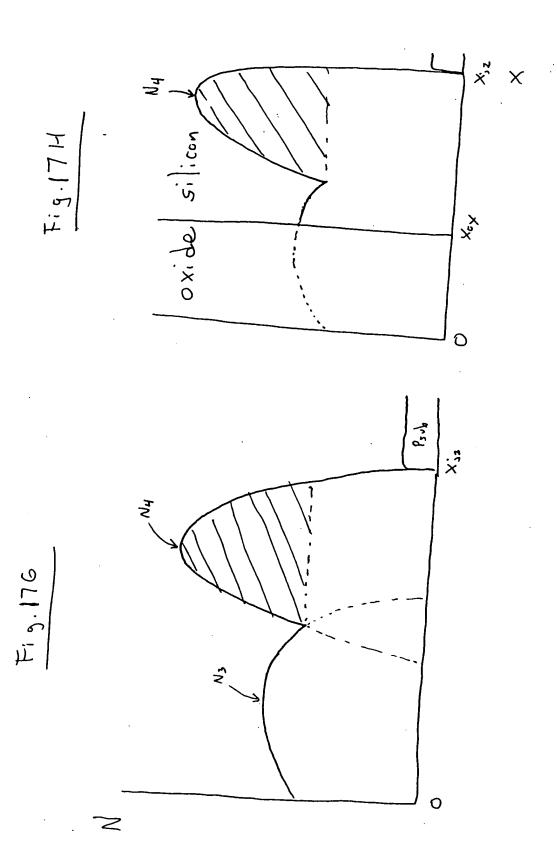


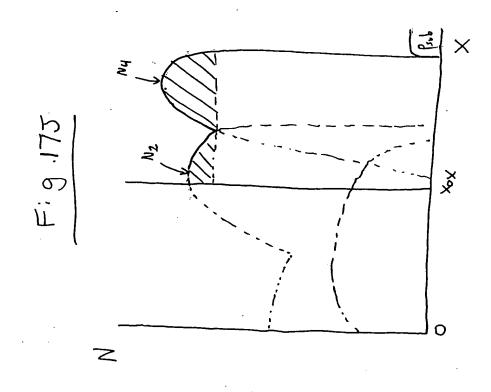


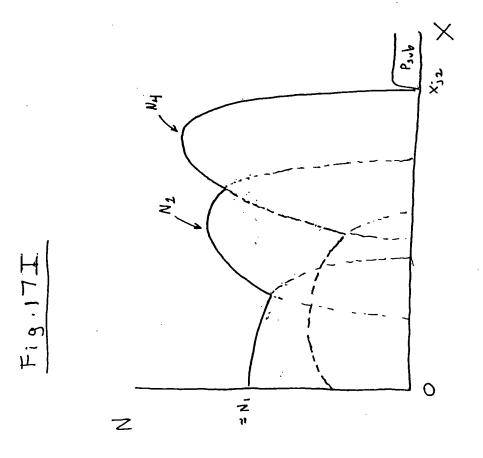
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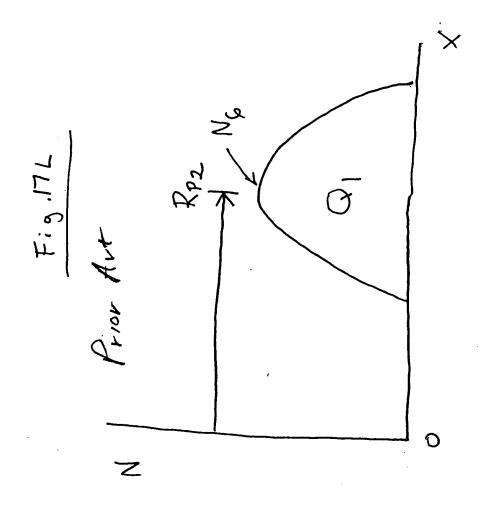


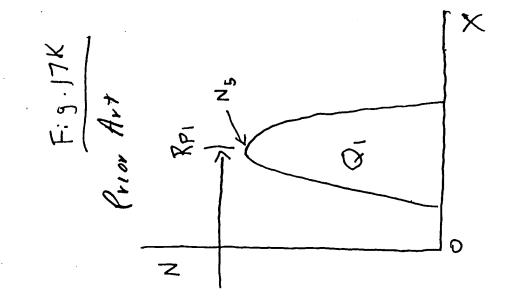
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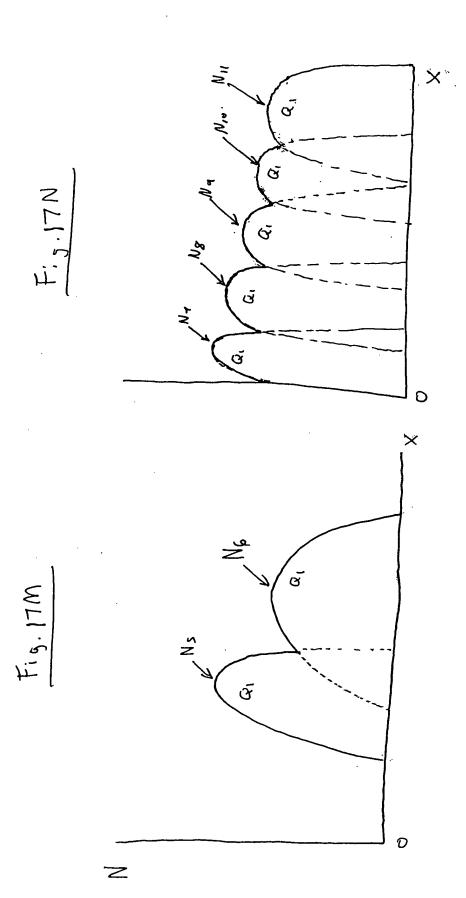


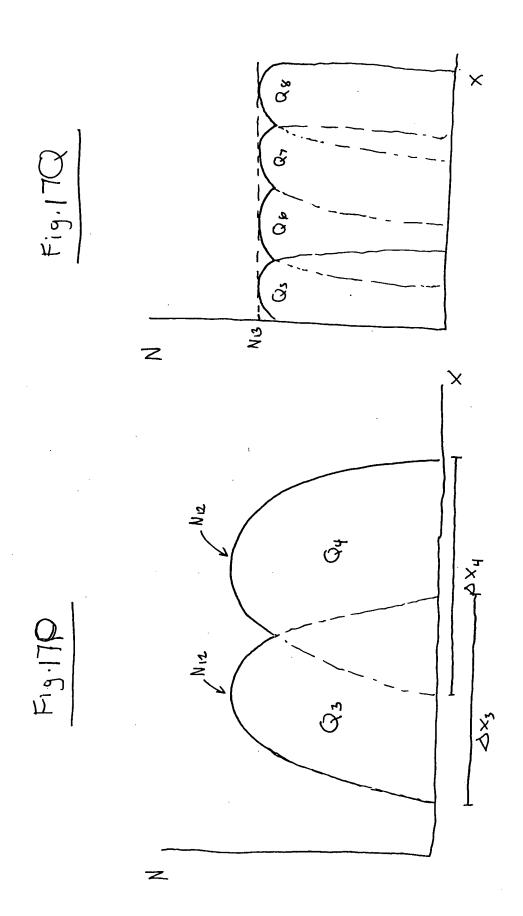


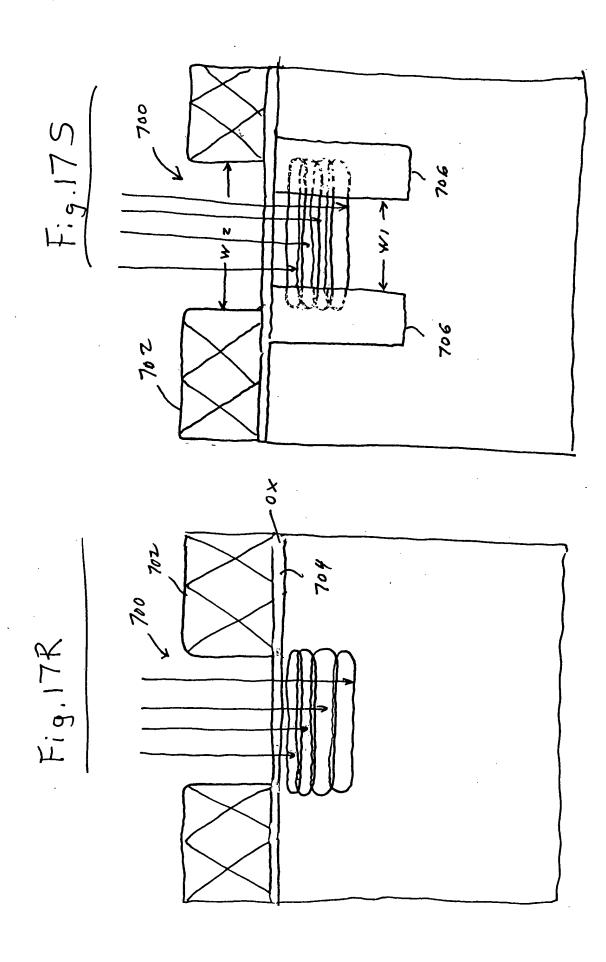


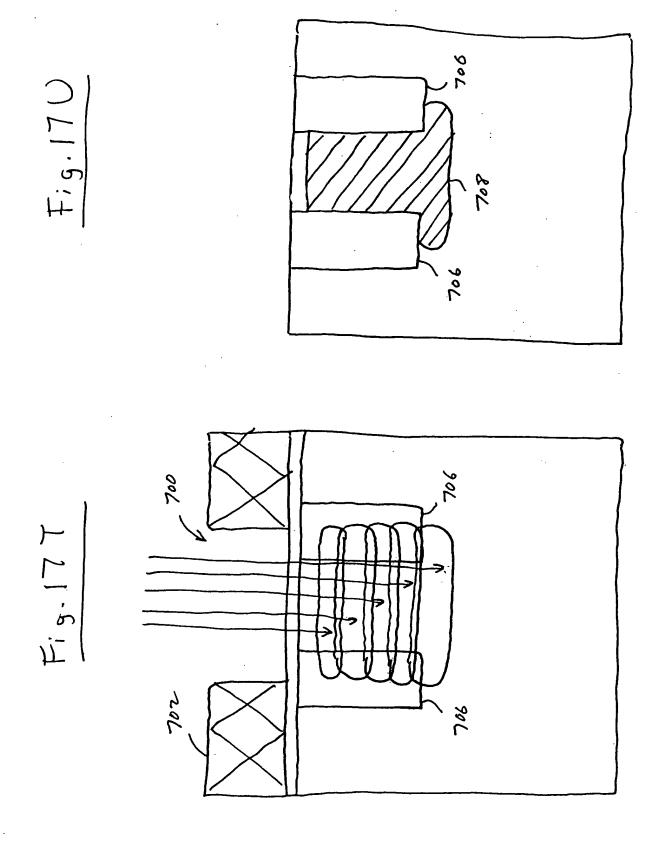


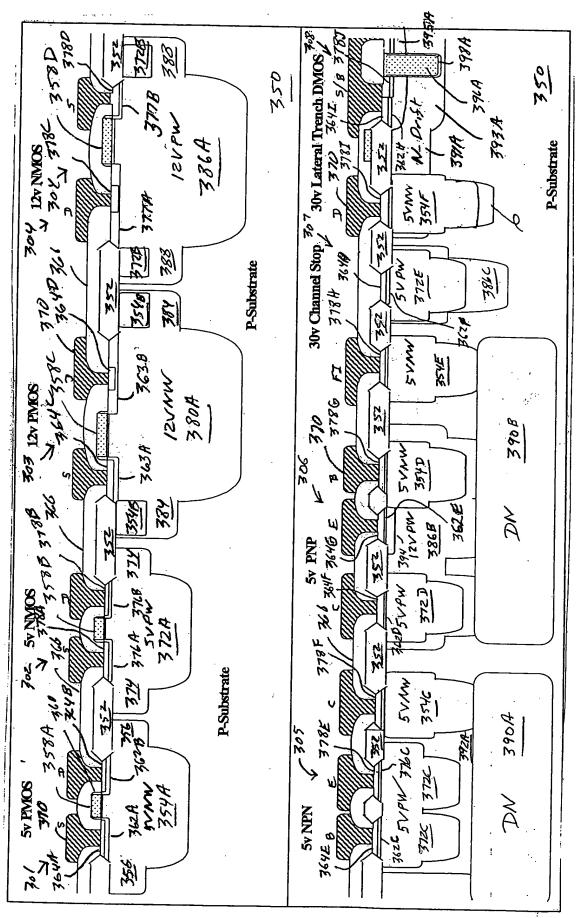




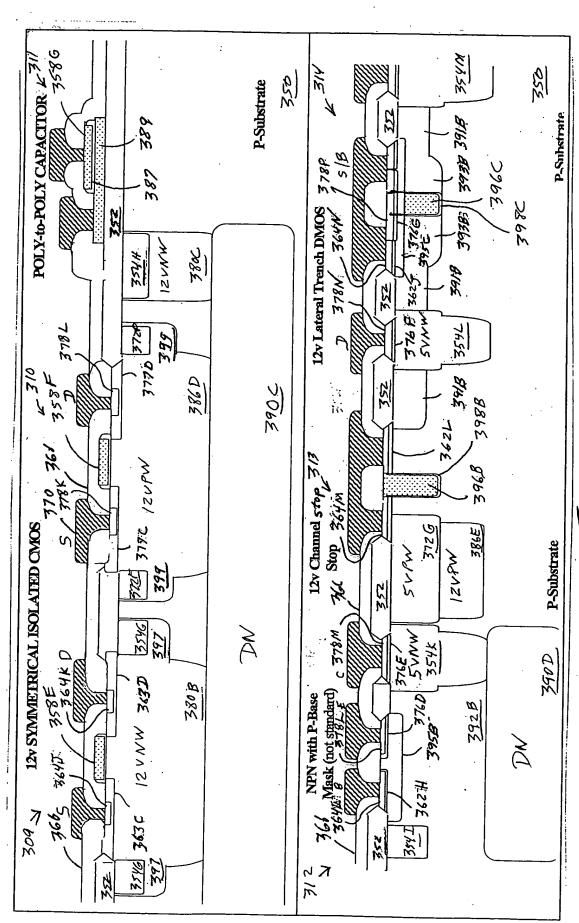




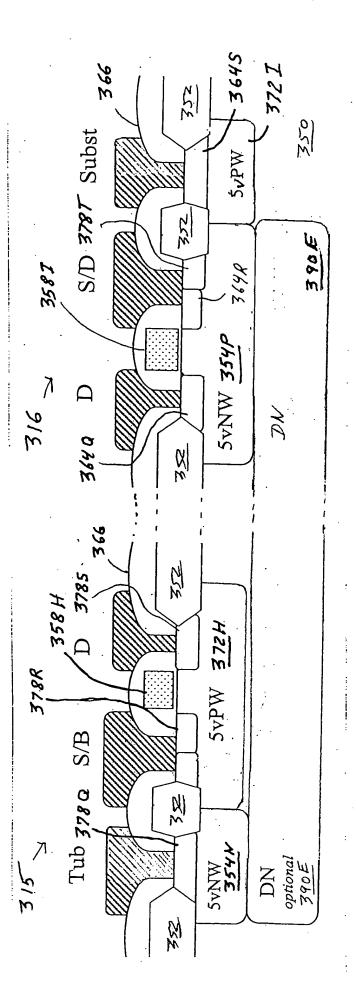




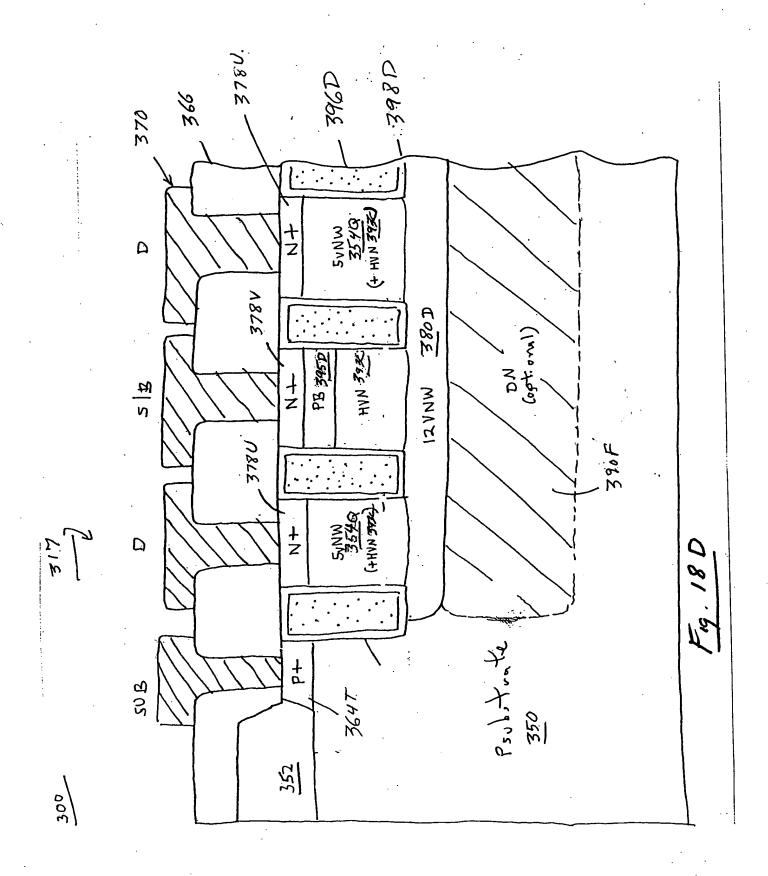
F19. 18A

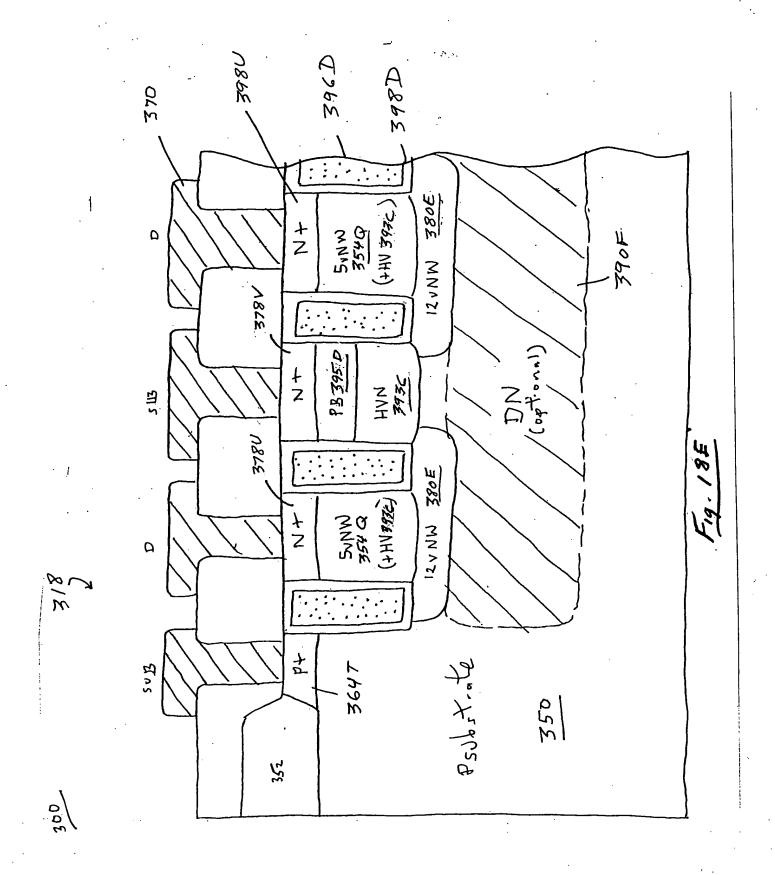


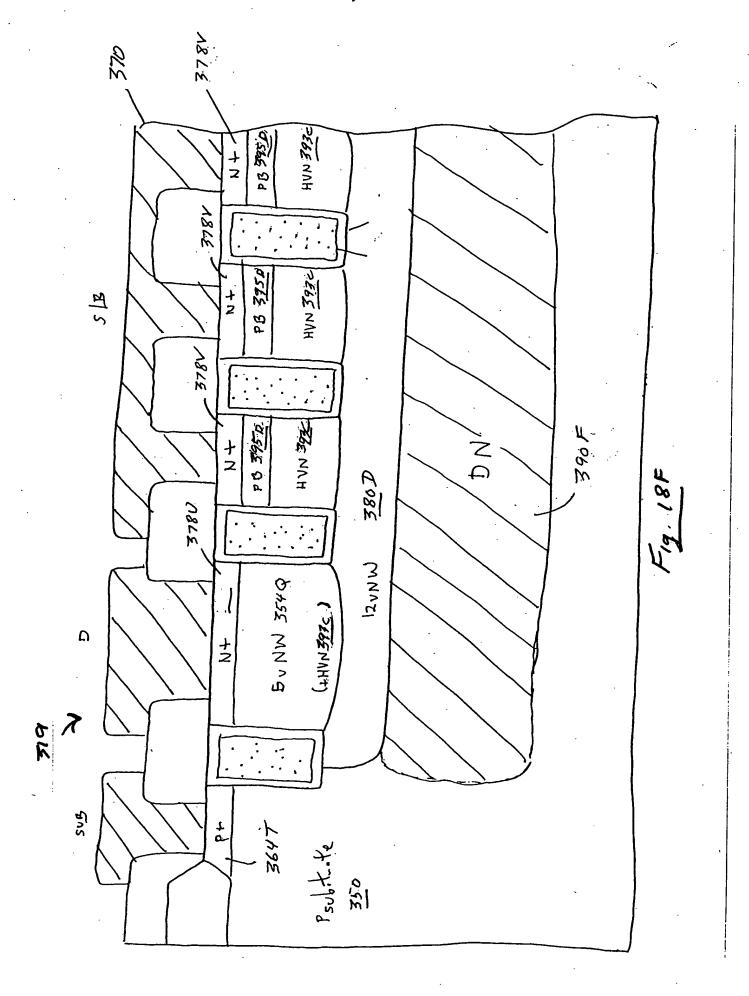
F.9. 18B



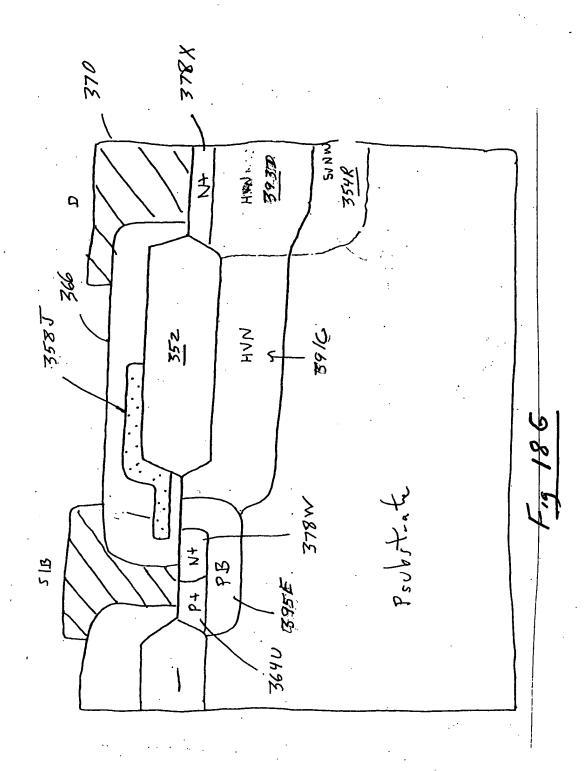
F19 18C

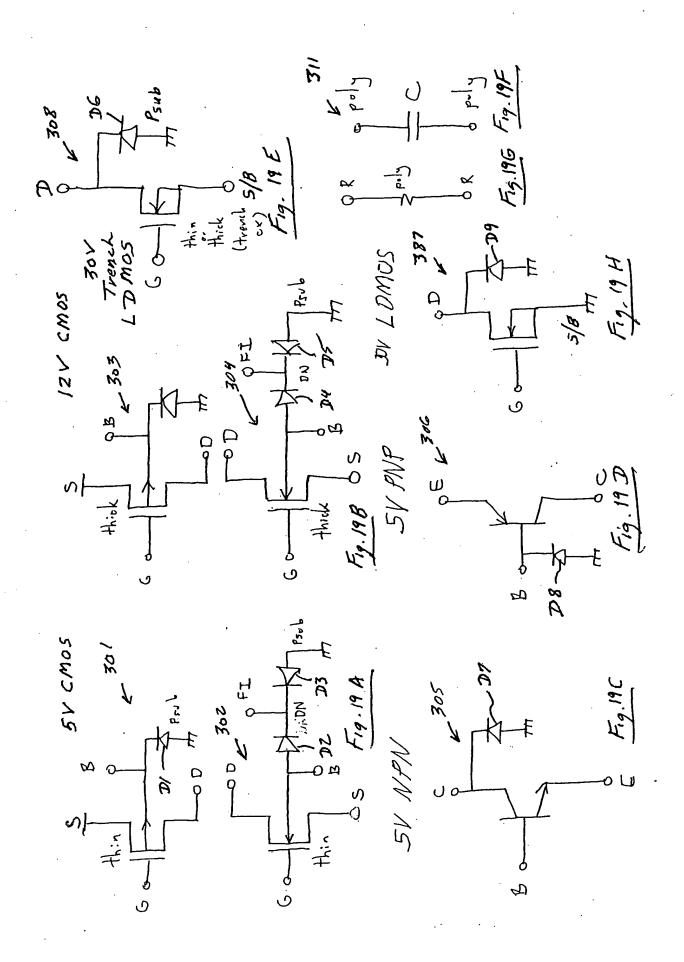


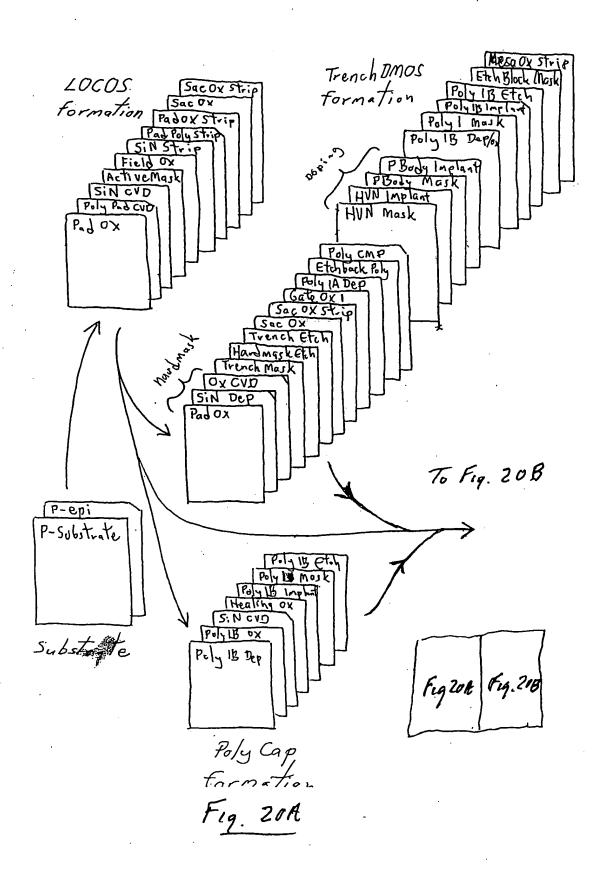


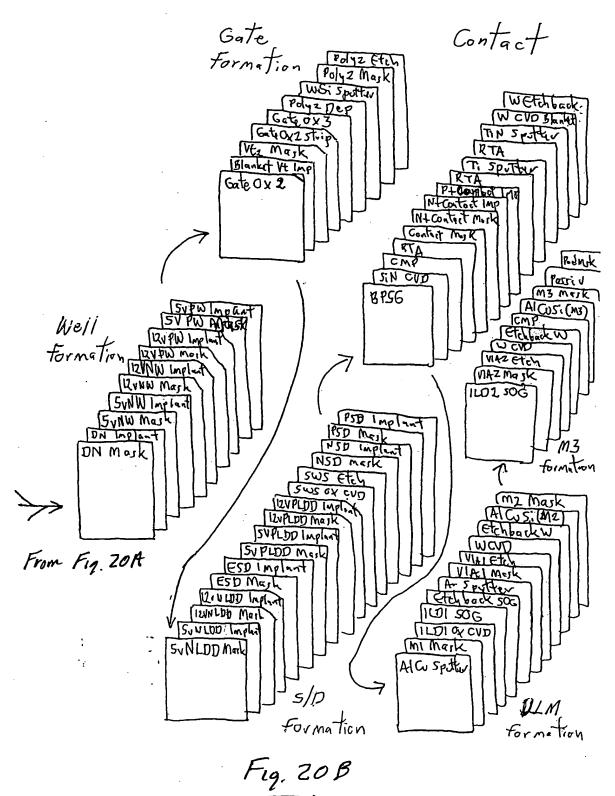


228



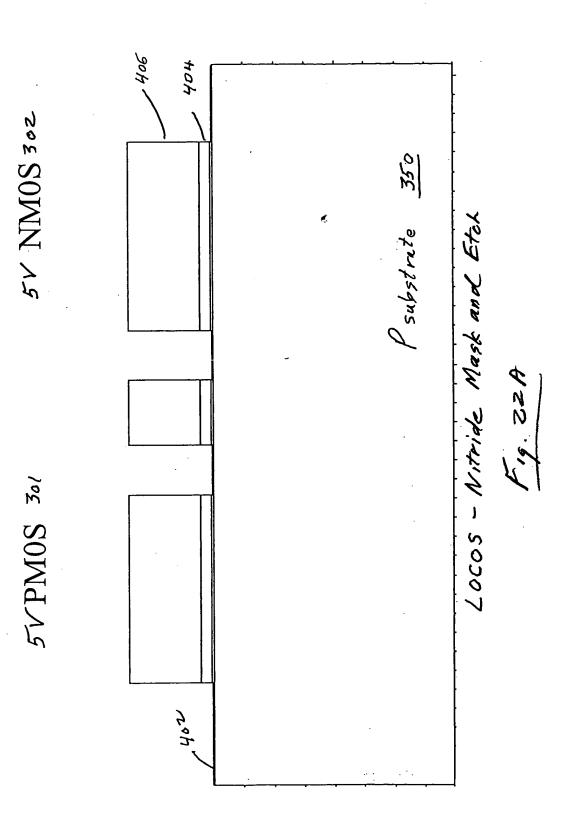






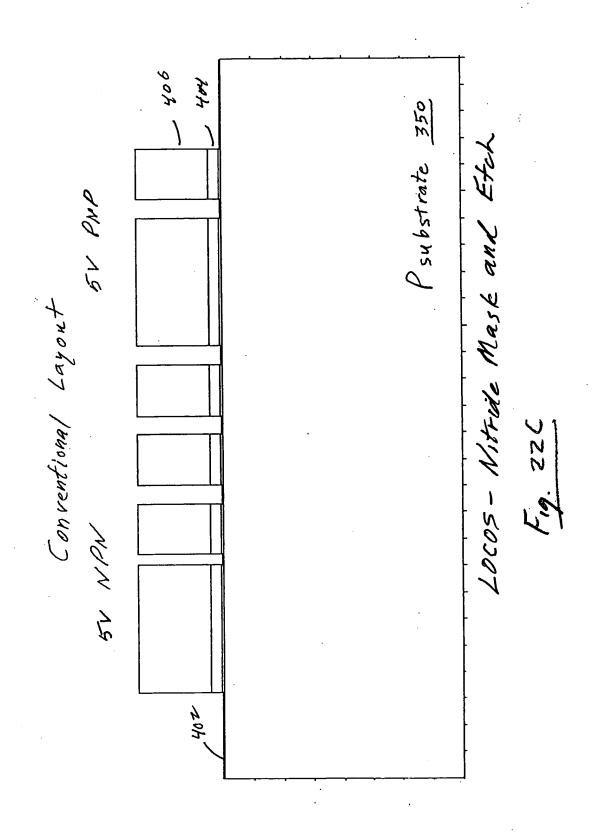
70h

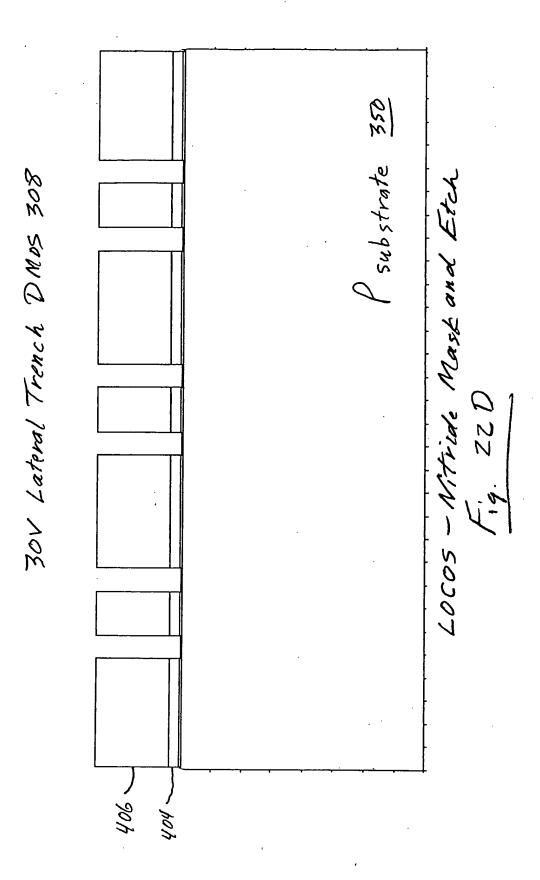
350 First Pad Oxide Layer Fig 21



90% 404 Psubstrate 350 Locos - Witride Mask and Etch 5V PNP 306 High Fr Layout 5V NPN 305 70h

F19. 22B





Symmetrical 12 V CMOS

12V PM0S 309

12V NMOS 310

HOH LOCOS - Nitride Mask and Etch Psubstrate 350 400

51 NMOS 302

5V PM0S 301

LOCOS - Field Osidation Fig. 23A

High Fr Layout

SV NON 305

5 V PNP 306

2000s - Field Oxidation

F19. 23B

235 Psubstrate 350 SVPNP Conventional Layout HOH NUN 15 hoh

355

LOCOS- Field Oxidation

Fig 23C

352 350 304 Lateral Trench DMOS substrate Hon - 352 F. 352 HOH

LOCOS - Field Cridation

Fig. 23D

ale. SOWN 121 Symmetrical 12 V CMOS 12 r PMOS 309

Locos - Field Oxidation

Psubstrafe 350 408 Second And Oxide Layer Fry. 24A 408 352

5V NM0S 302

5V PM0S 301

205 AND 72 High FT Layout SV NPN 305

Substrate 350 80% 80h 355

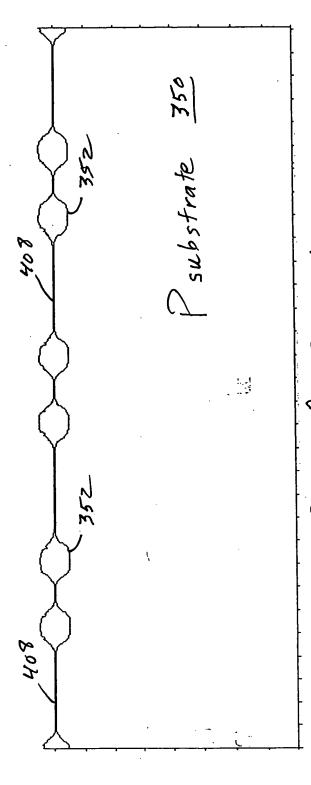
Second lad Oxide Layer
Fig. 248

352 Substrate 350 5V PNP 80h Second Rad Oxide Layer Fig. 24C , '7[‡] 80H 5V NPN 355

Layout

Conventional

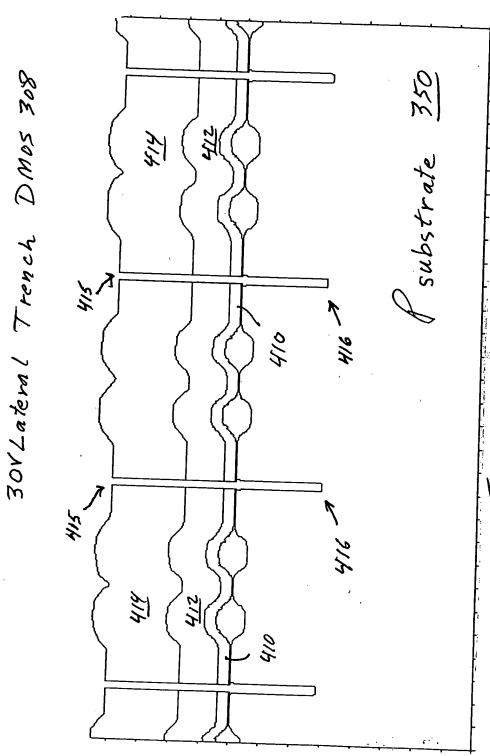
30V Lateral Trench DMOS 308



Second Pad Oxide Layer

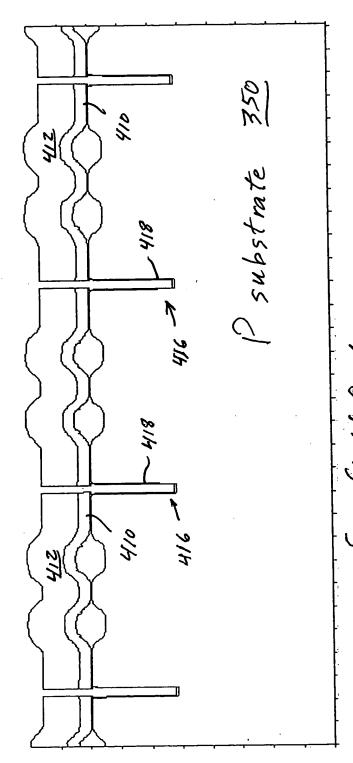
12V PMOS 309 12V CMOS 710

Psubstrate 350 .408 Second Pad Oxide layer 352 804



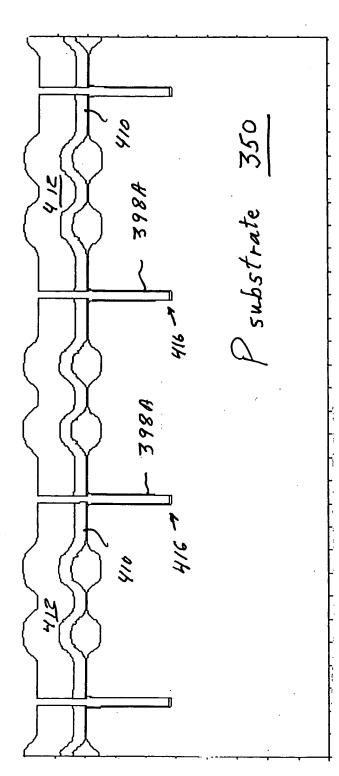
Trench Hard Mask

30V Lateral Trench DMOS 308



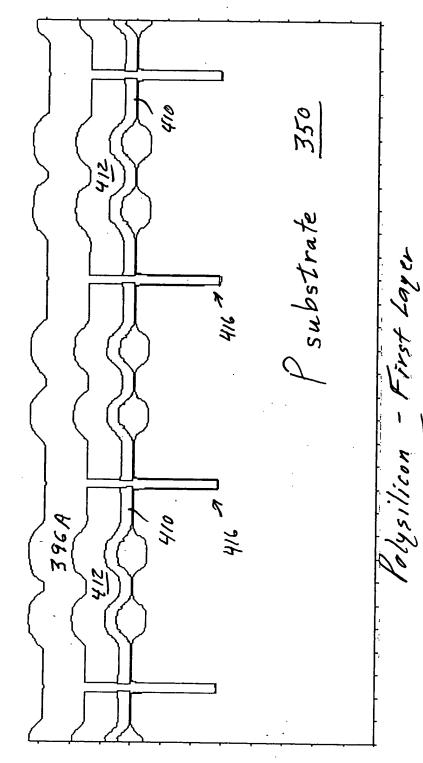
Sacrificial Oxide

30 V Lateral Trench DMOS 308



Trench Gate Oxide Fig. 2712

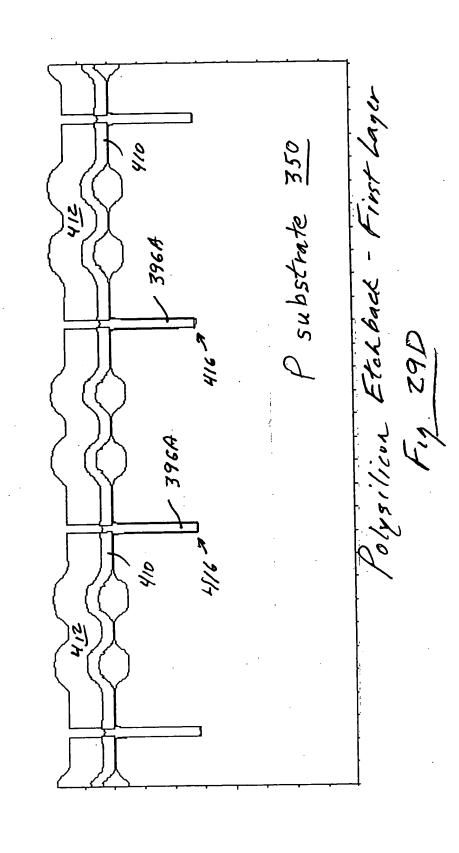
30 V Lateral Trench DMOS 308



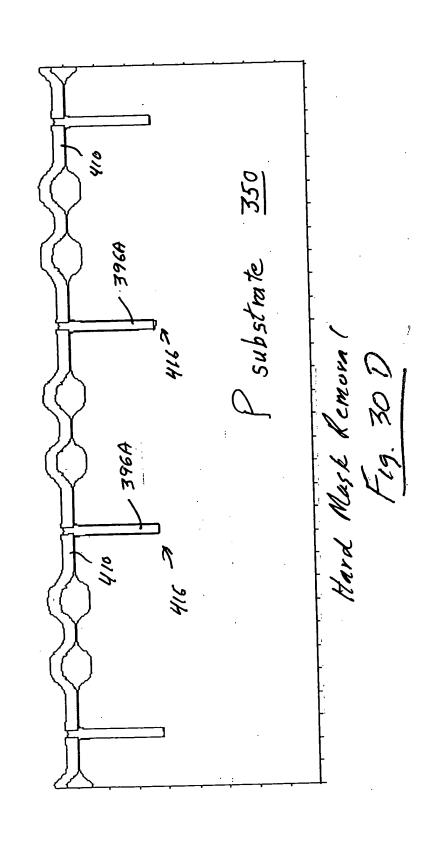
19 28D

, -

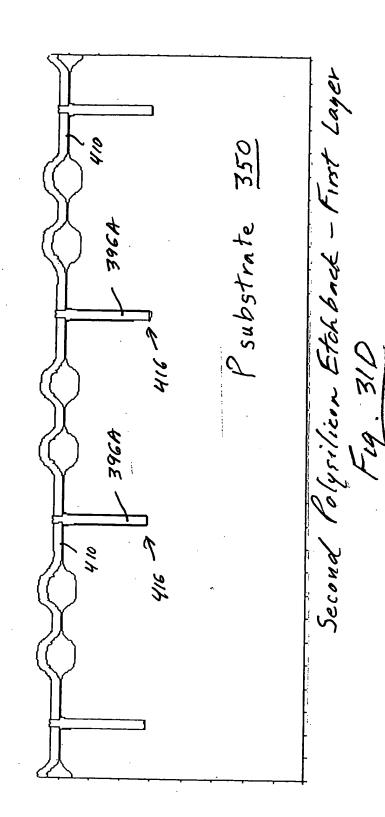
30V Lateral Trench DMOS 308



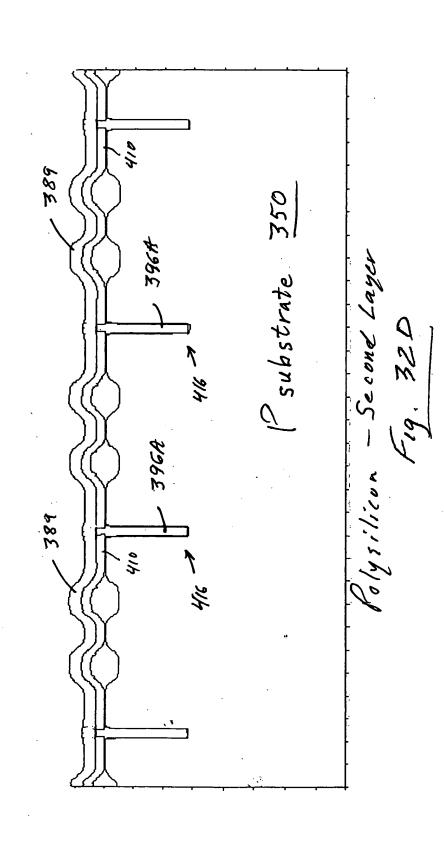
30V Lateral Trench DMUS 308



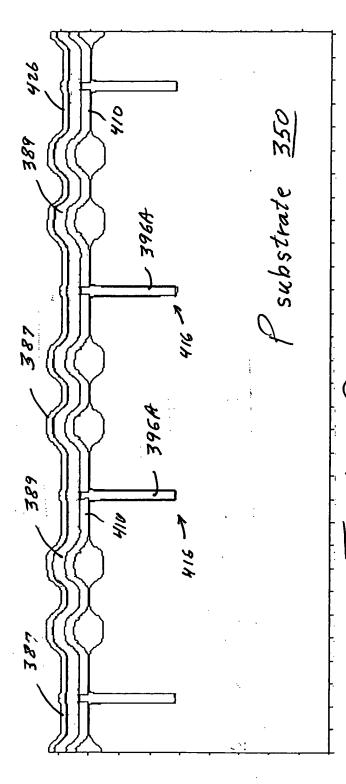
- 30 V Lateral Trench DMOS 308



30V Lateral Trench DMOS 308

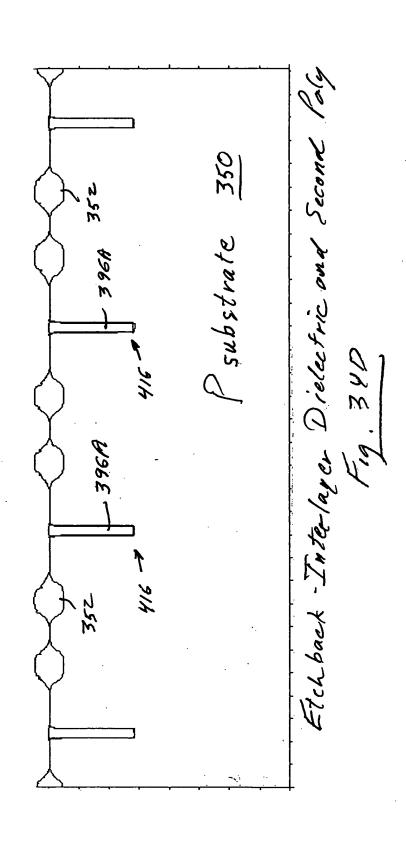


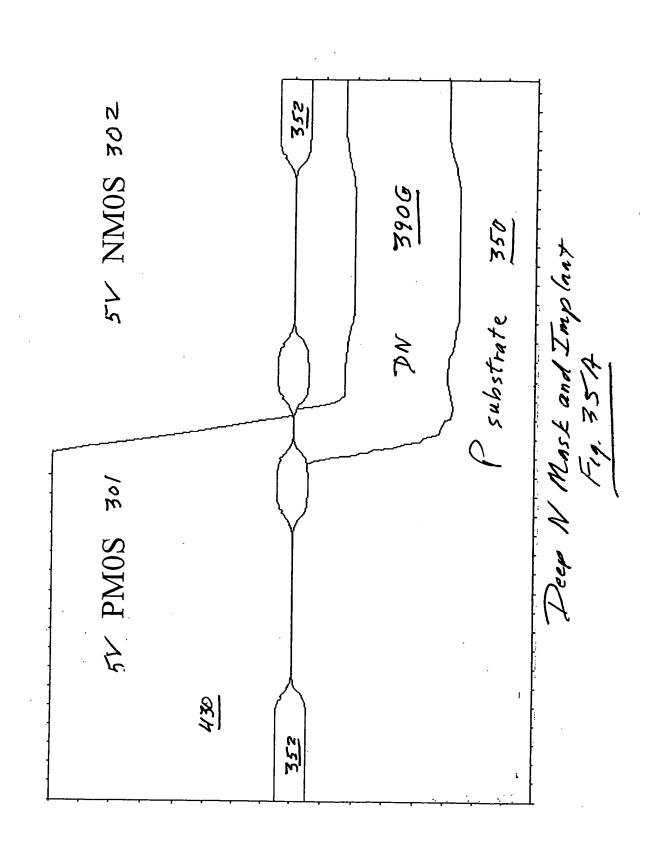
308 30V Lateral Trench DMOS

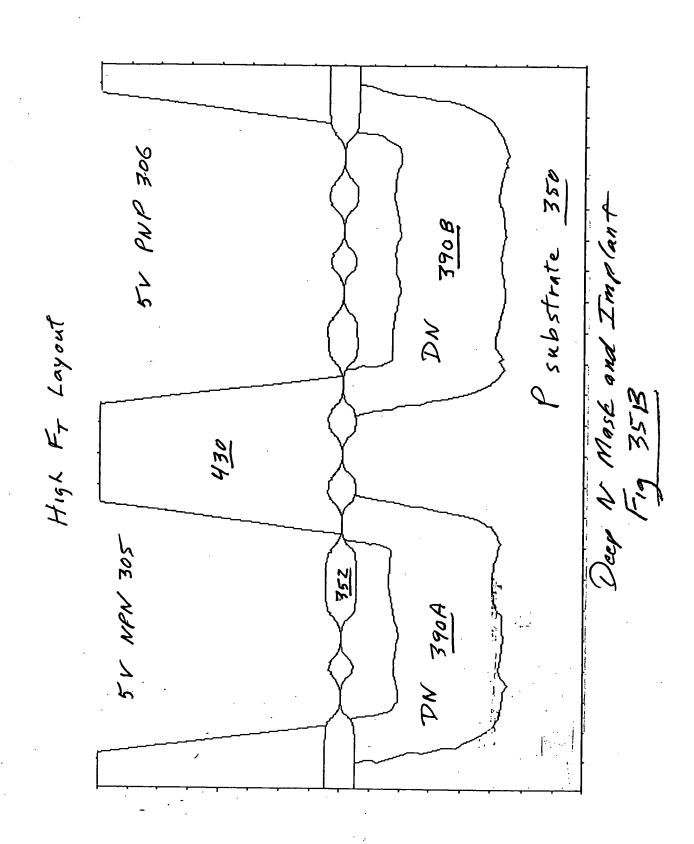


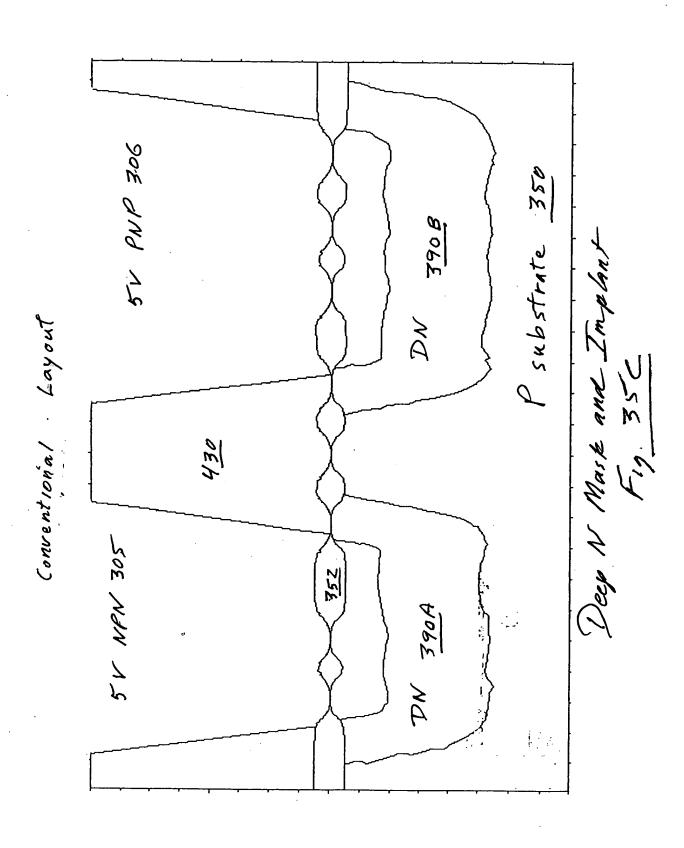
Interlayer Dielettric Fig 33D

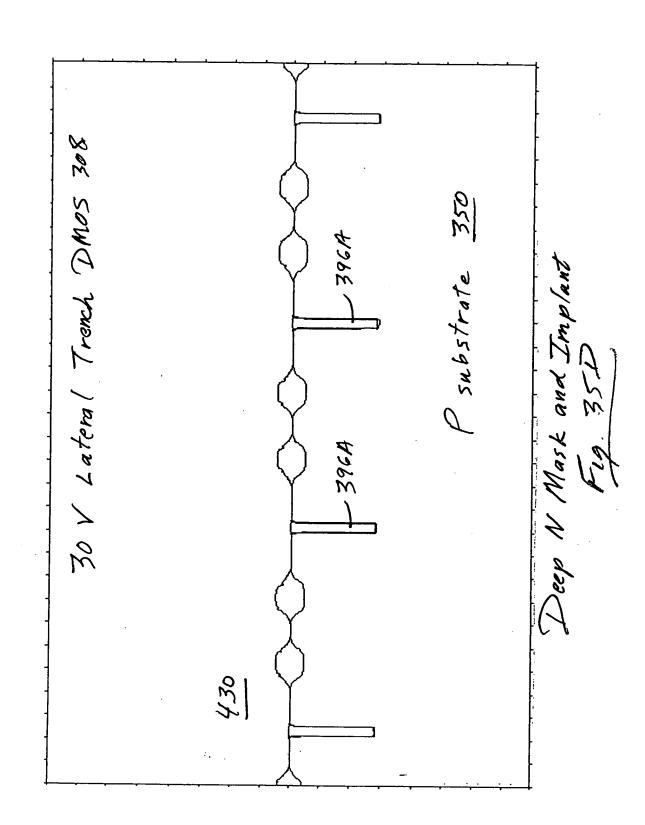
30 V Lateral Trench DMOS 308

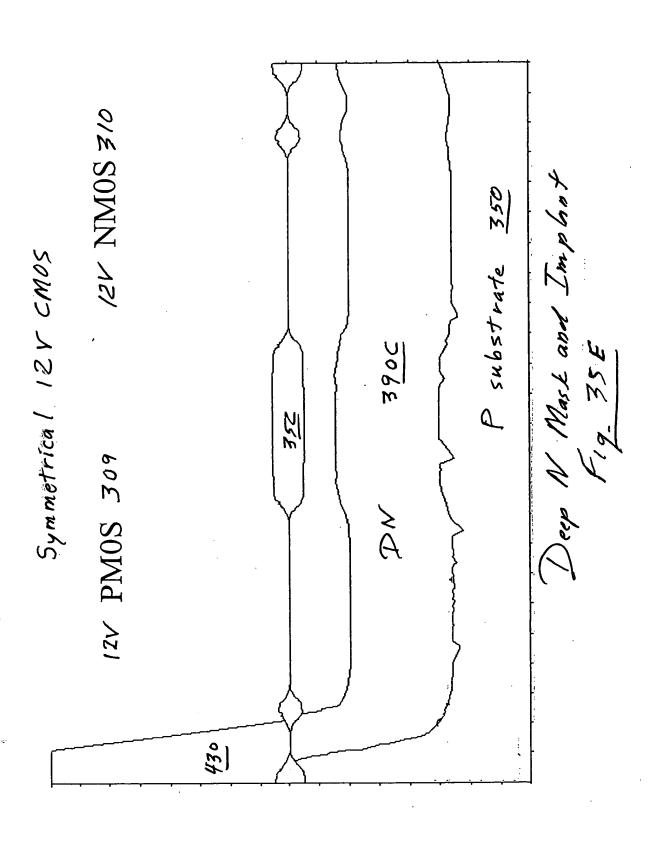


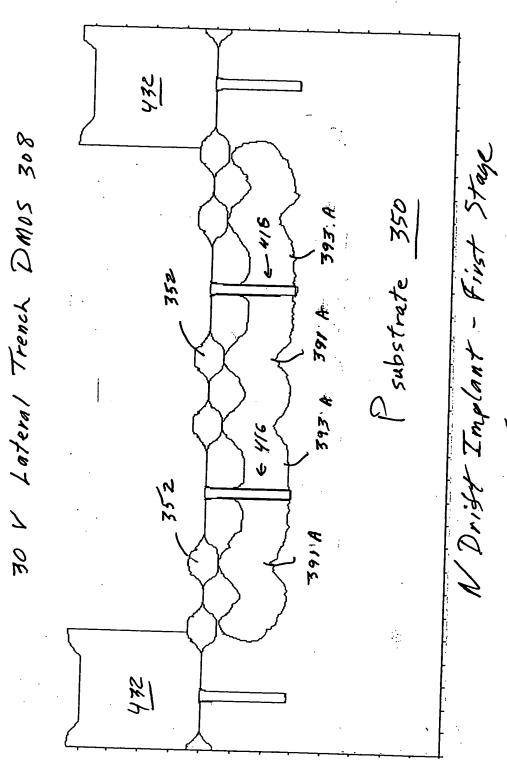






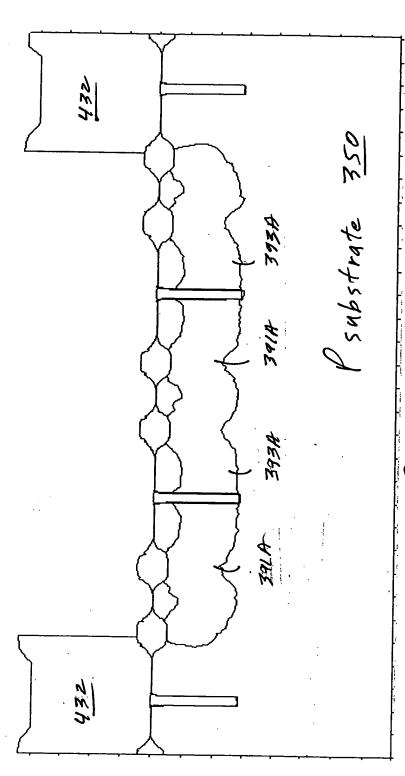




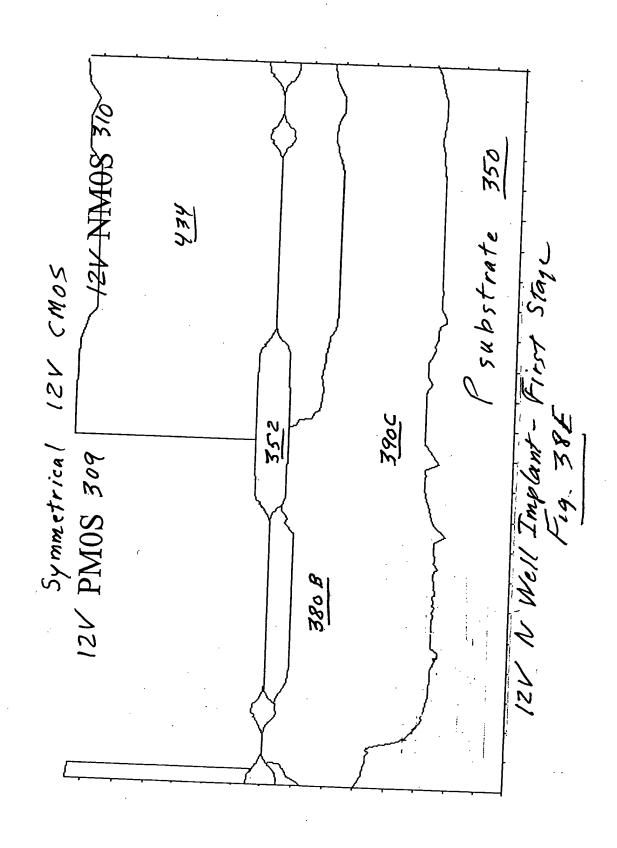


F19, 360

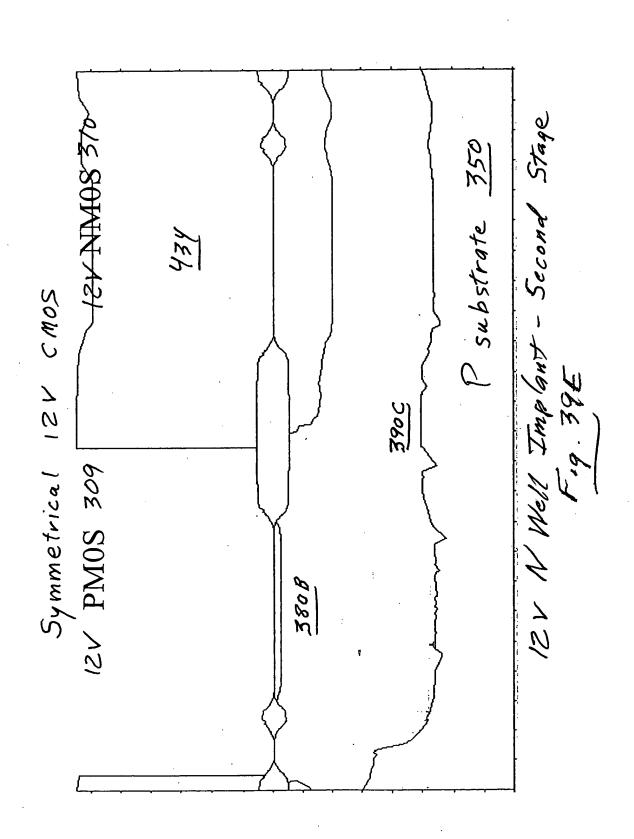
30 V Lateral Trench DMOS 308

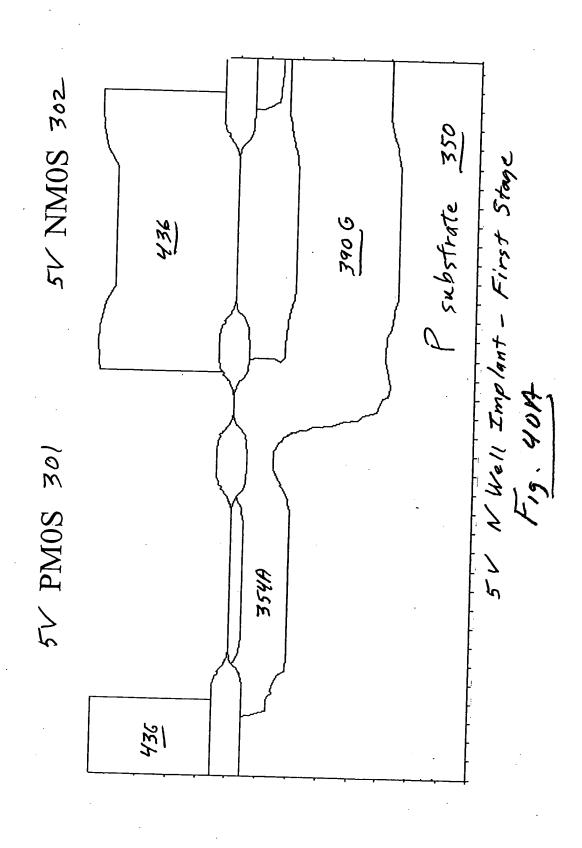


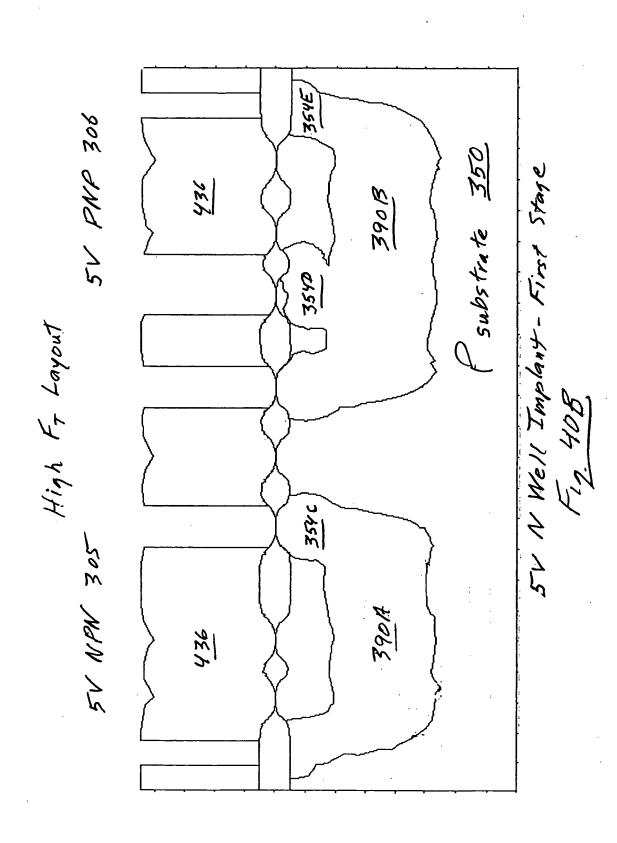
N Drist Impart - Second Stage Fig. 37 D

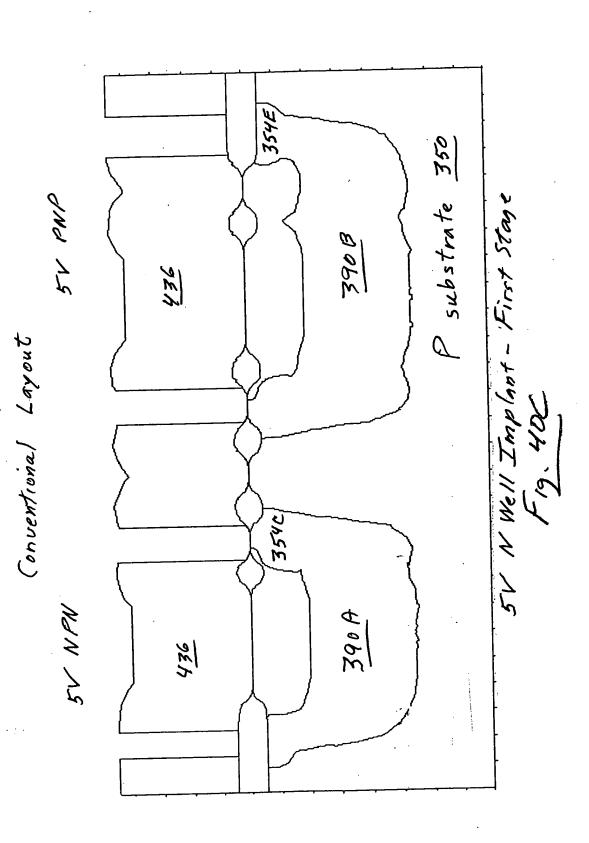


Ì.

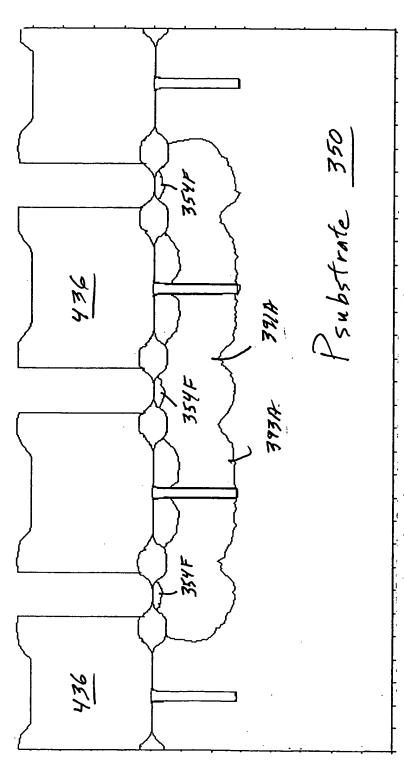




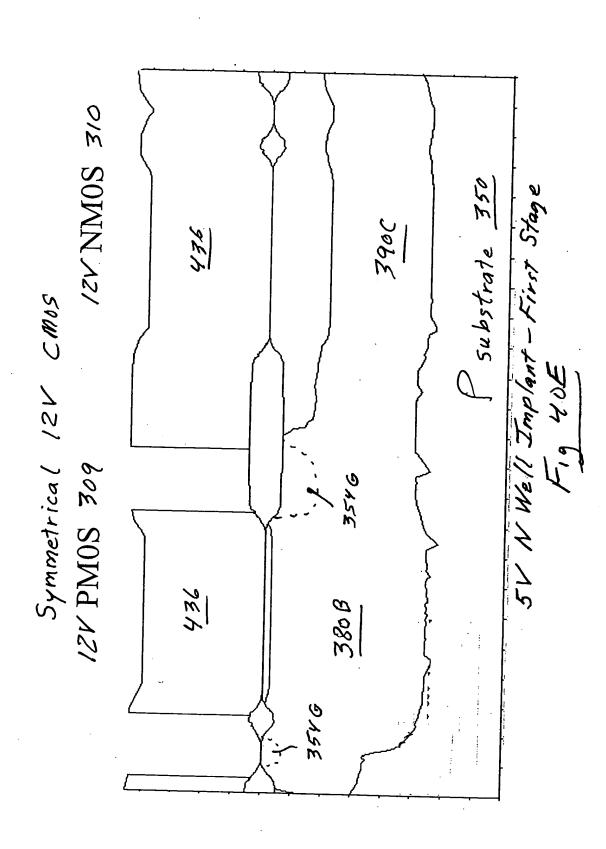


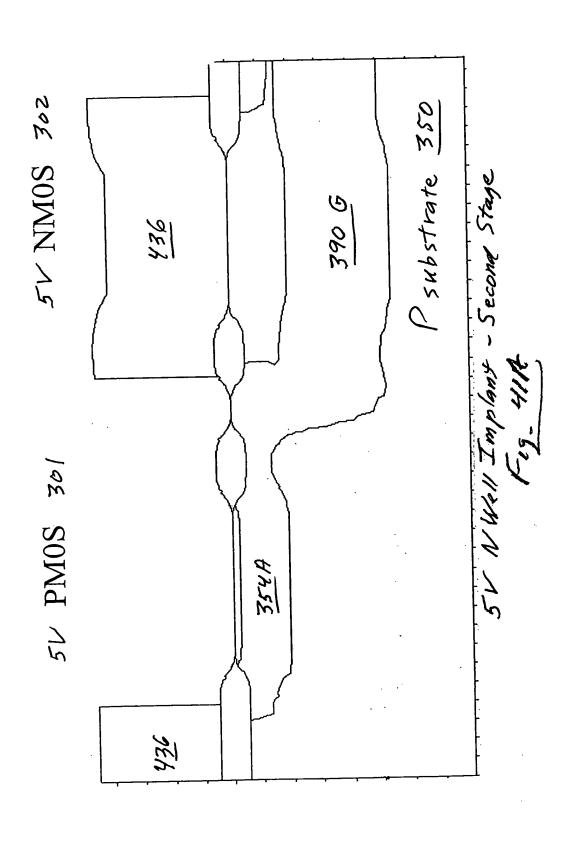


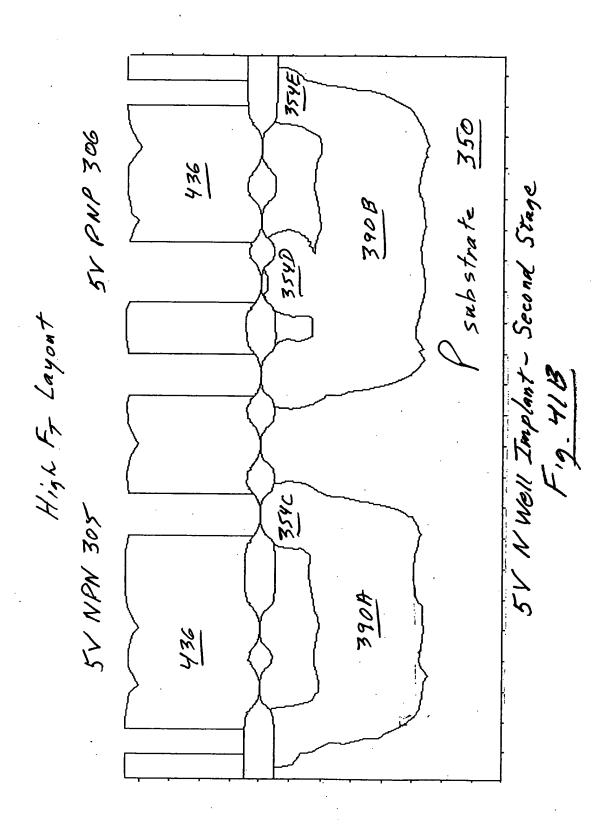
30V Lateral Trench DMOS 308

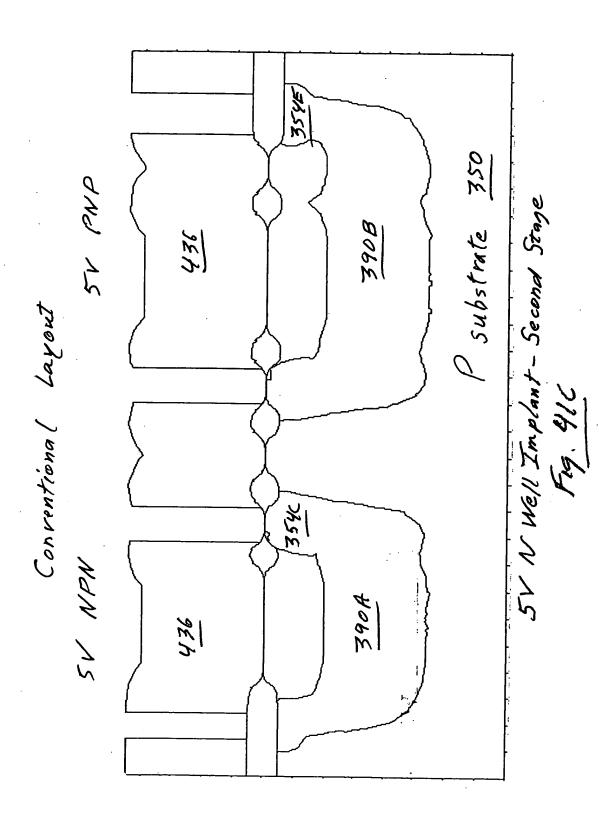


SV NWell Implant - First Stage

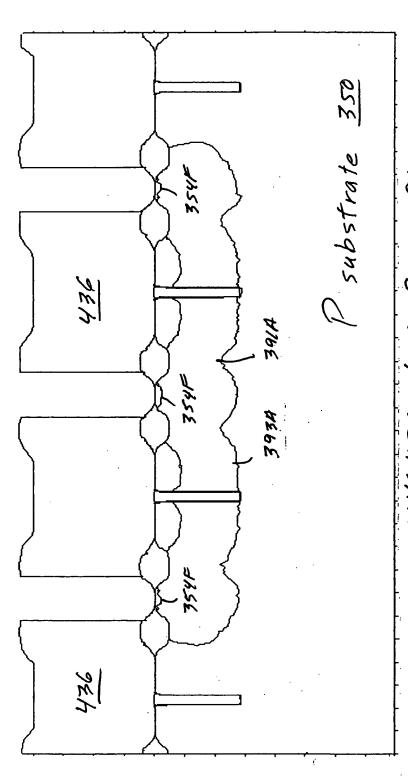




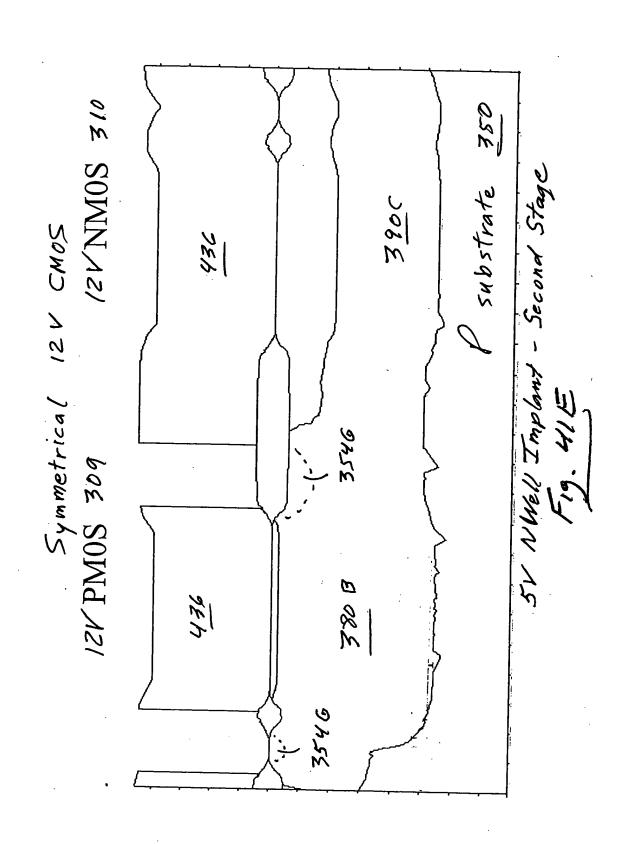


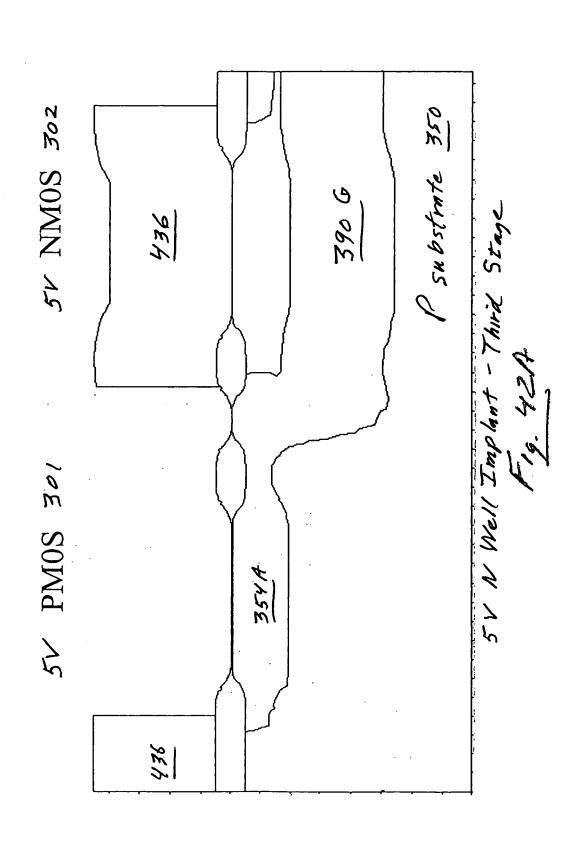


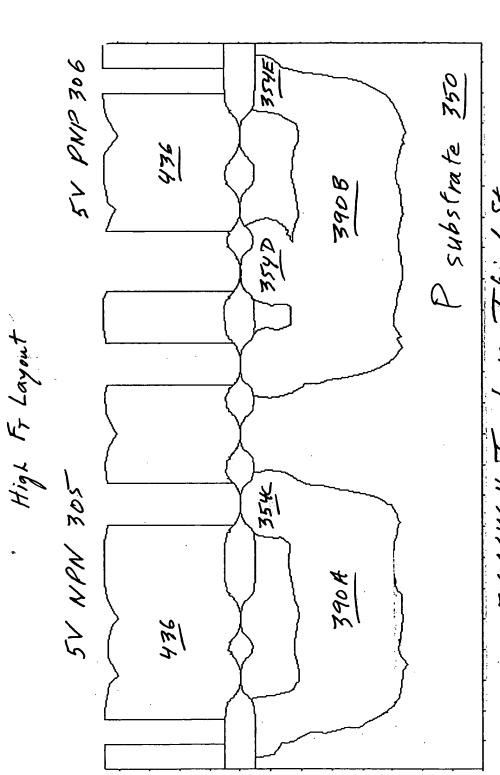
30V Lateral Trench DMOS 308



5V NWell Implant - Second Stage Fig. 41D

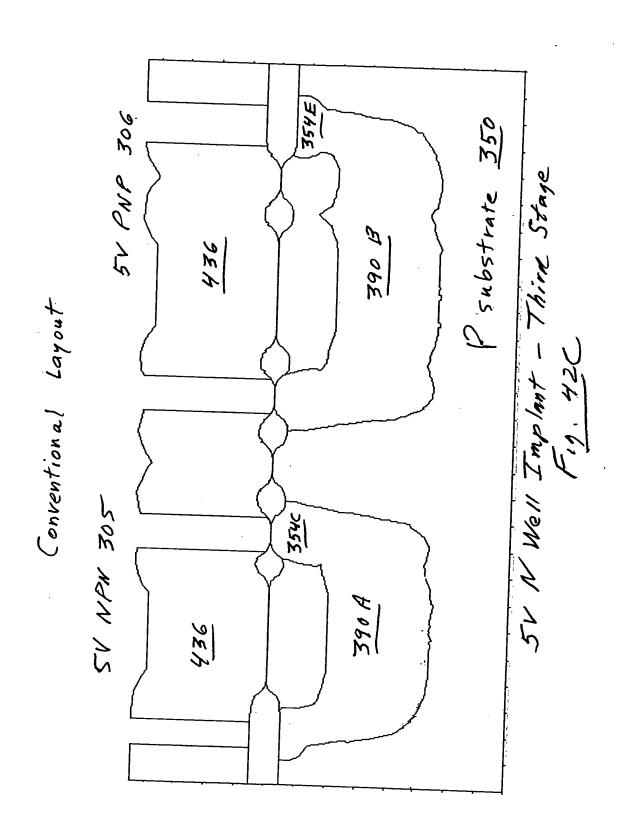




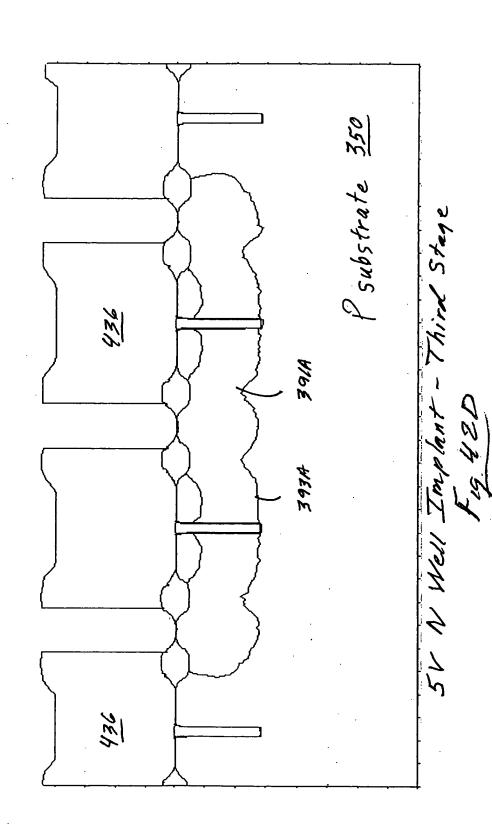


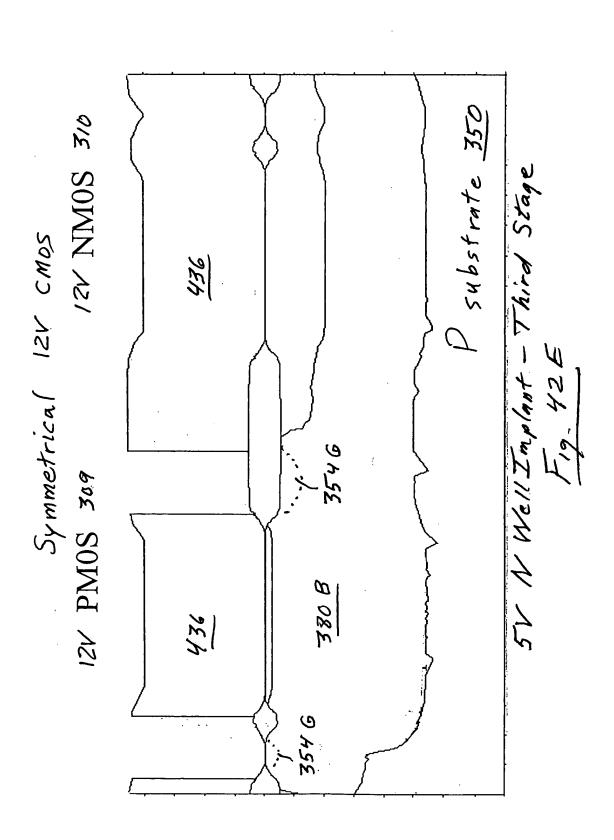
5V NWell Implant - Third Stage

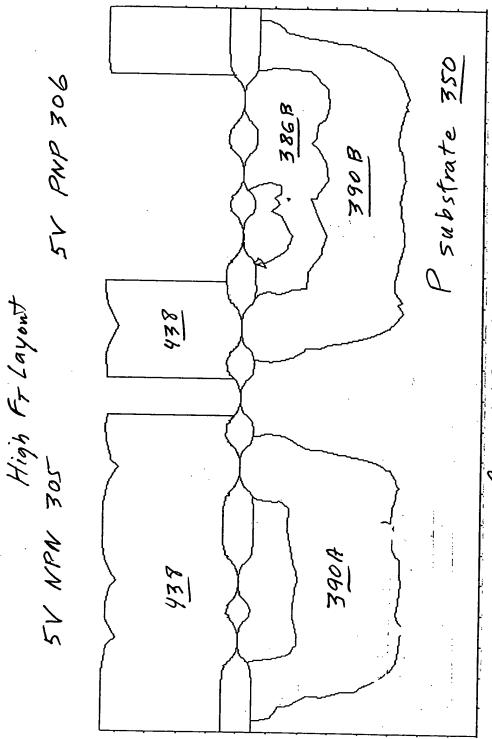
·



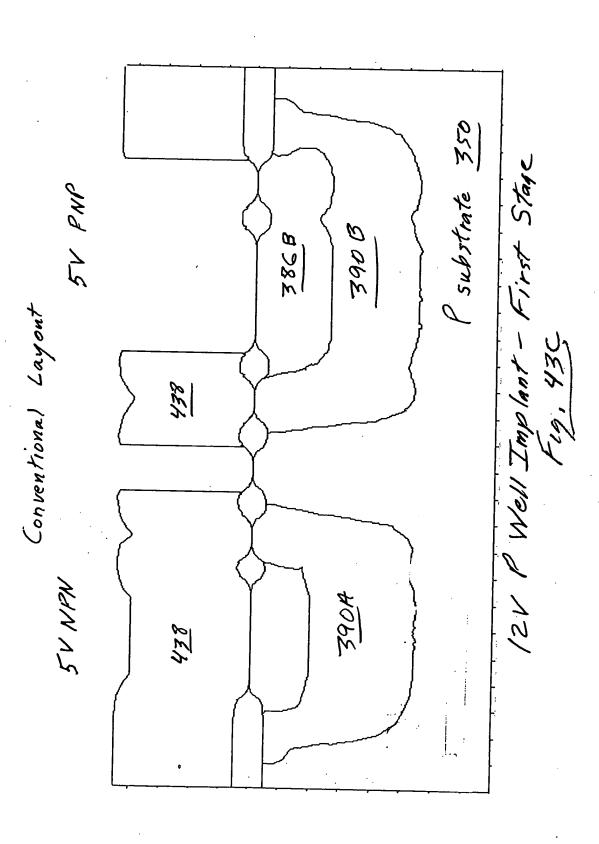
30 V Lateral Trench DMOS 308

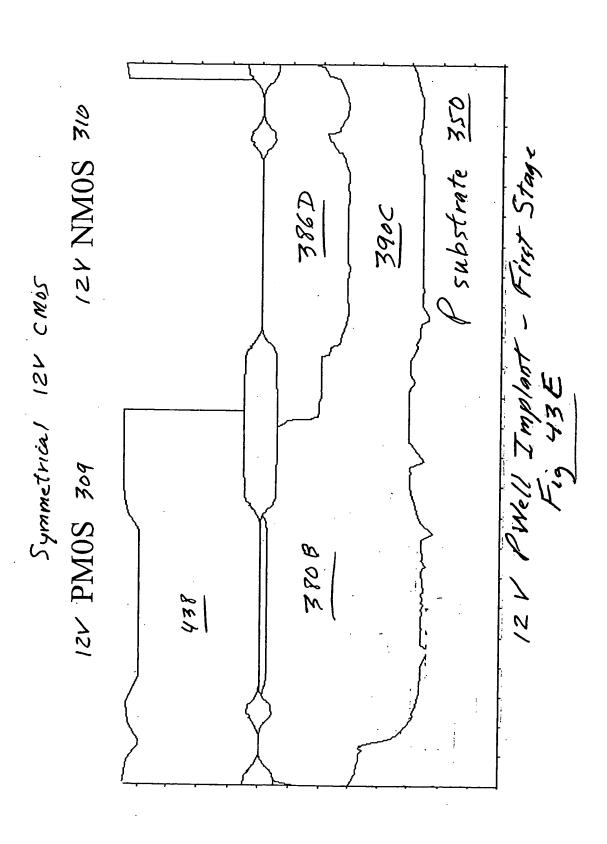




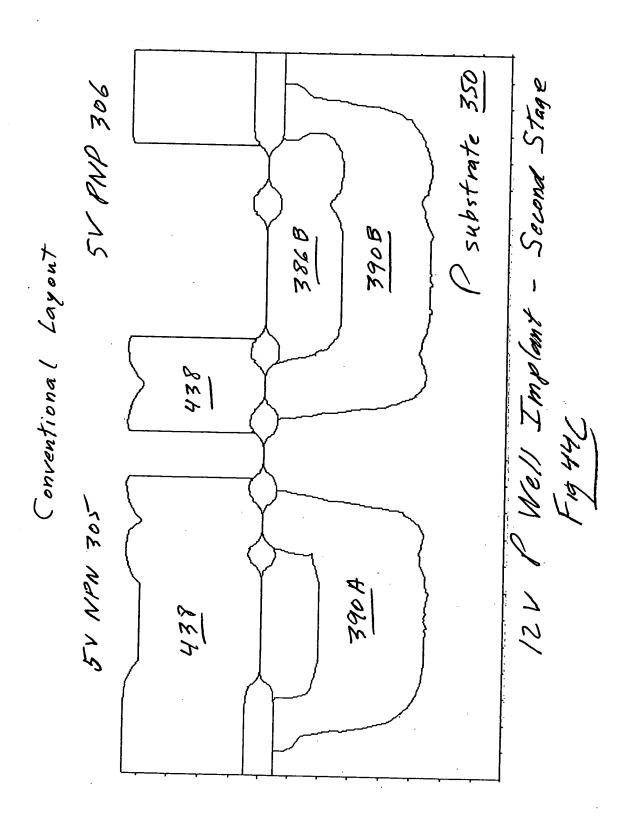


12V P Well Implant - First Staye Fig. 43B

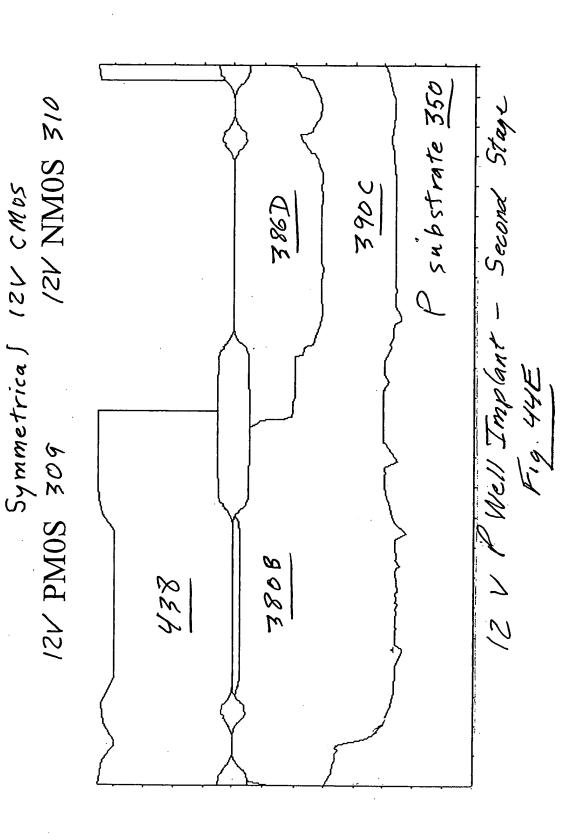


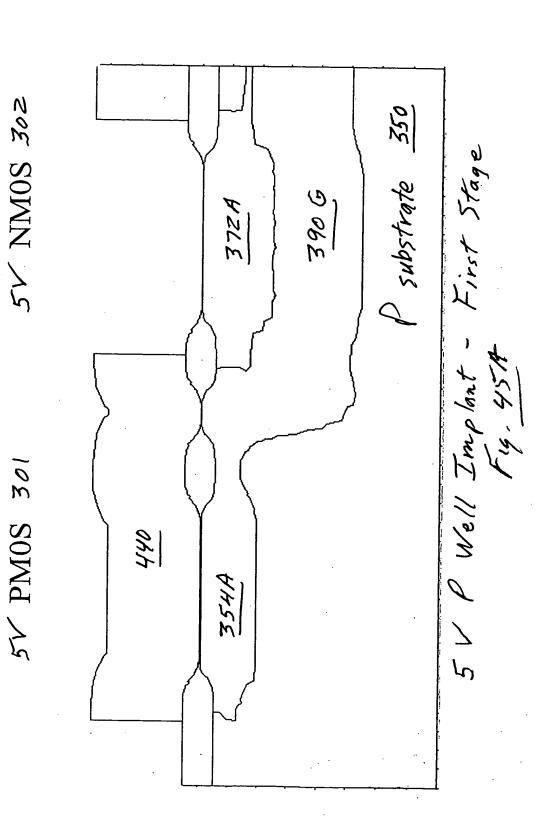


P Substrate 350 12V P Well Implant - Second Stage 5V PNP 306 E1 98 E 340 B High Fr Layout 438 5V NPN 305 390 R 438



: *j* |:-



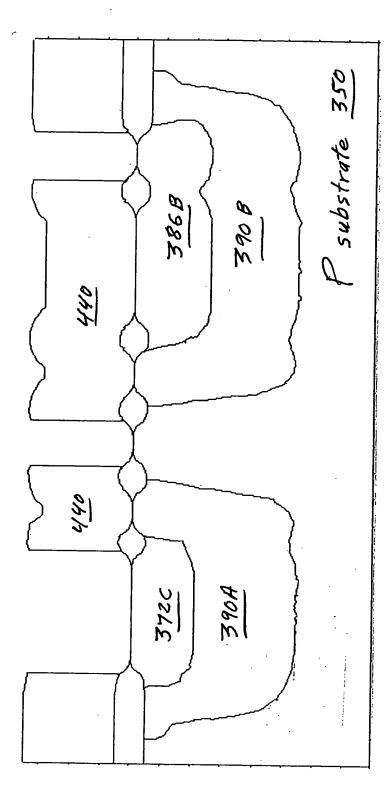


1 substrate 350 5V PNP 306 386 B 5V P Well Implant - First Stage 390 8 246 High FT Layout 120 5V NPN 305 340 A 3720

Conventional Layout

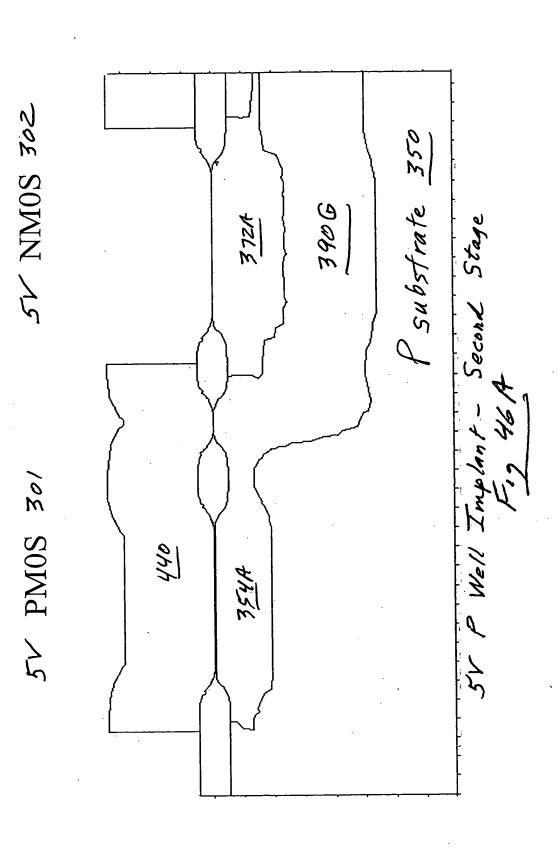
convention 5V NPN

5V PNP

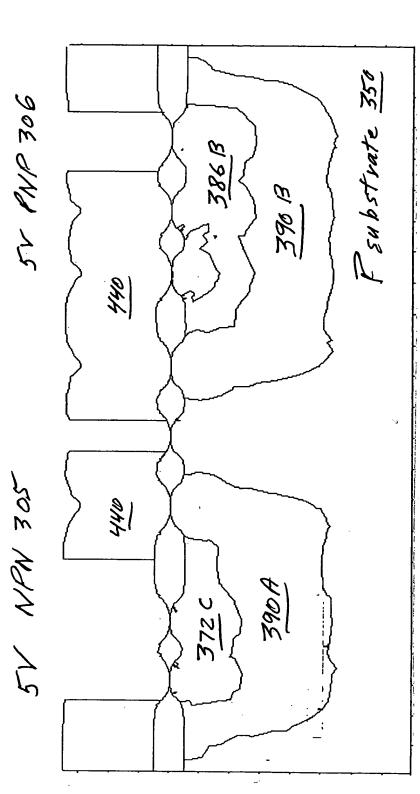


5V P Well Implant - First Stage

372F P substrate 350 0/2 NIMOS 3/0 5V P Well Implant - First Staye £ 386 390C 140 Symmetrical 12V CMOS 12V PMOS 309 12V (32E) 3808 440



High Fr Layout

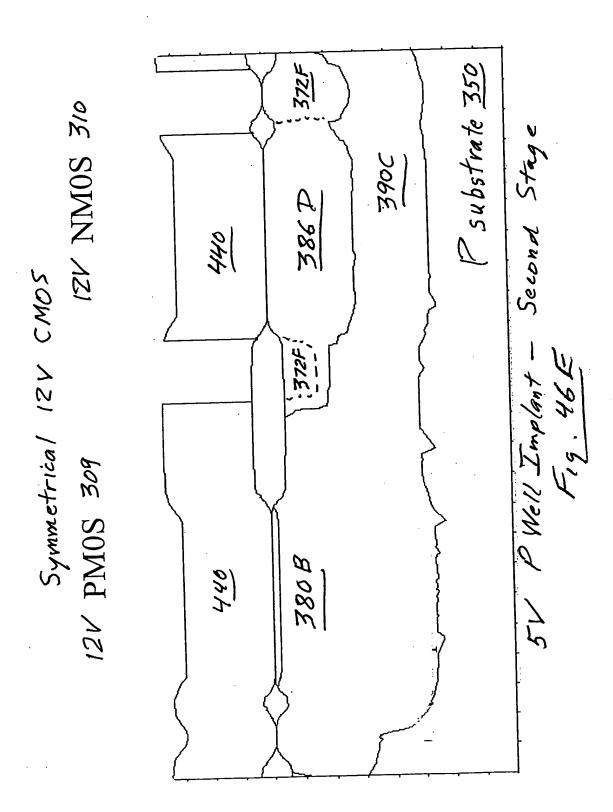


Second Stage SVP Well Implant -

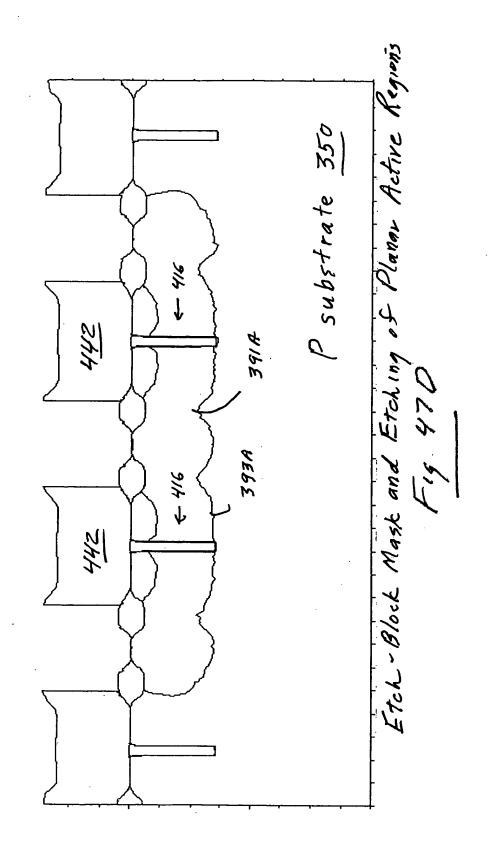
5V PNP 306 Conventional Layout 5V NPN 305

5V P Well Implant - Second Staye

F19. 46C



30V Lateral Trench DMOS 308



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5V PM0S 301

5V NM0S 302

l substrate 350 3906 444 372A First Planar Sate Oxide hhh ' 35414

12V NM0S 310 Symmetrical 12V CMOS 12V PMOS 309 12V

372F Psubstrate 350 390C 386 D 372F *ት*## 380 B

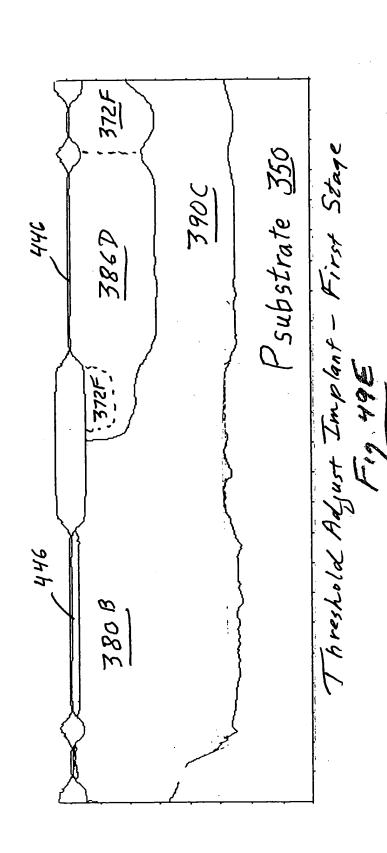
First Planar Gate Oxide

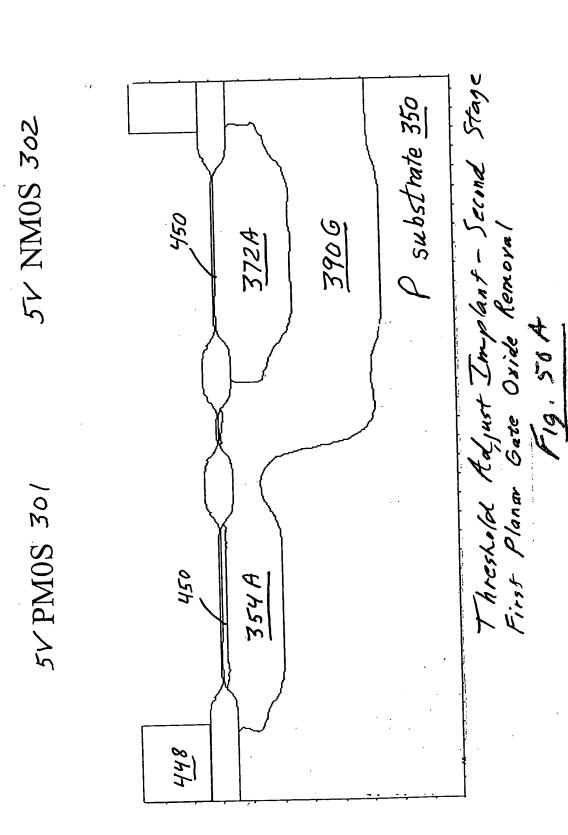
Threshold Adjust Implant - First Stage Psubstrate 350 944 3906 372 A 9/14 354 A

5V NM0S 302

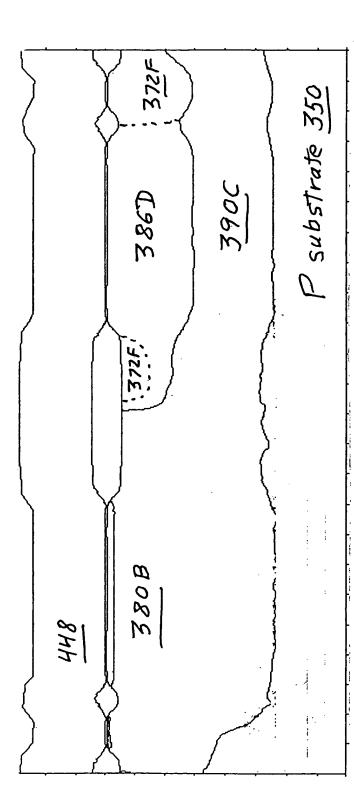
5V PM0S 301

/2V NM0S 3/0 Symmetrical 12V CMOS 12V PM0S 309





121 NMOS 310 Symmetrical 12V CMOS 12V PMOS 309 12V NM



Threshold Adjust Implant - Second Stage

5V NM0S 302 5V PM0S 301

P substrate 350 452 372A 3906 7.25/ 354A

Second

12V NM0S 310 Symmetrical 12V CMOS 12V PMOS 309 12V

372F Psubstrate 350 452 390C 386D 452 380B

Second Planar Gate Oxide

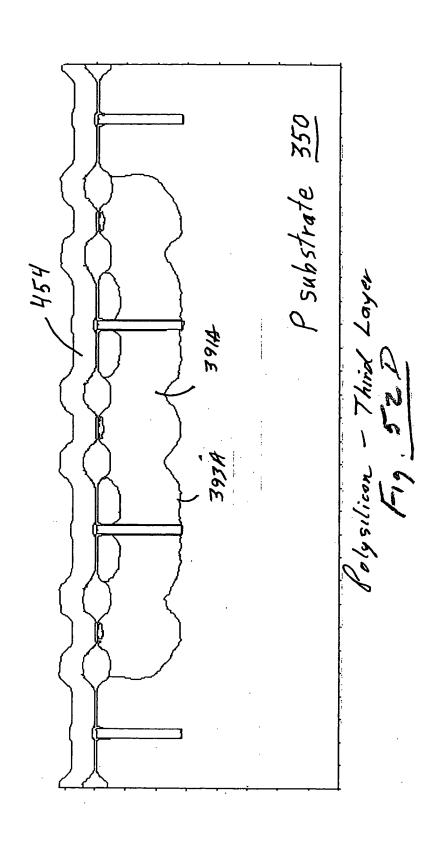
P substrate 350 3906 372A 354A 424

5V PM0S 301

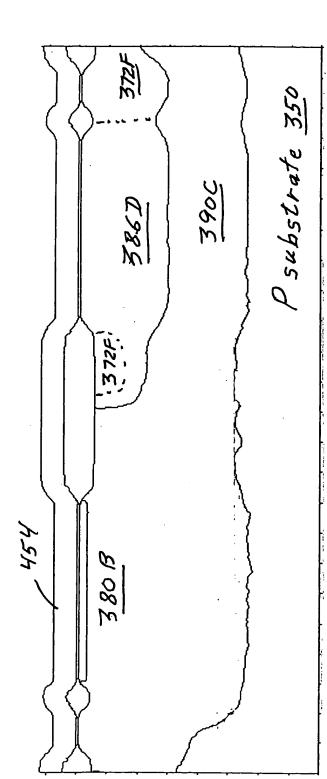
51 NM0S 302

1. 1

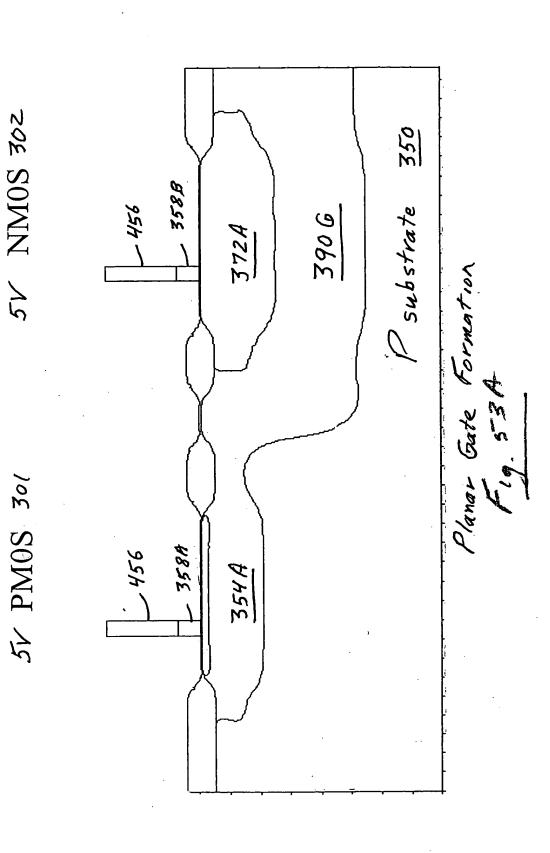
301 Lateral Trench DMQS 308



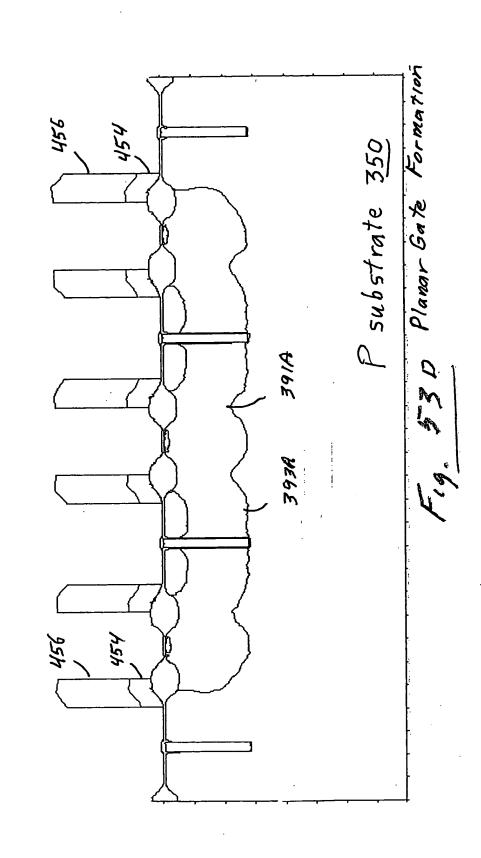
Symmetrica / 12V CMOS 12VPMOS 309 12V NMOS 310

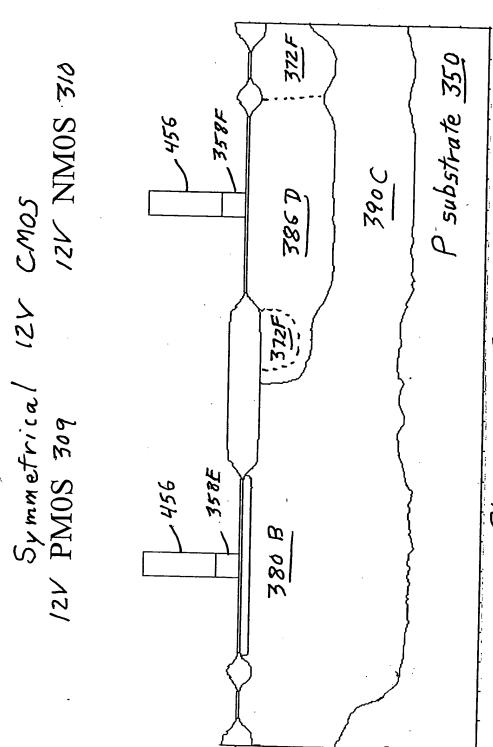


Polysilicon - Third Layer

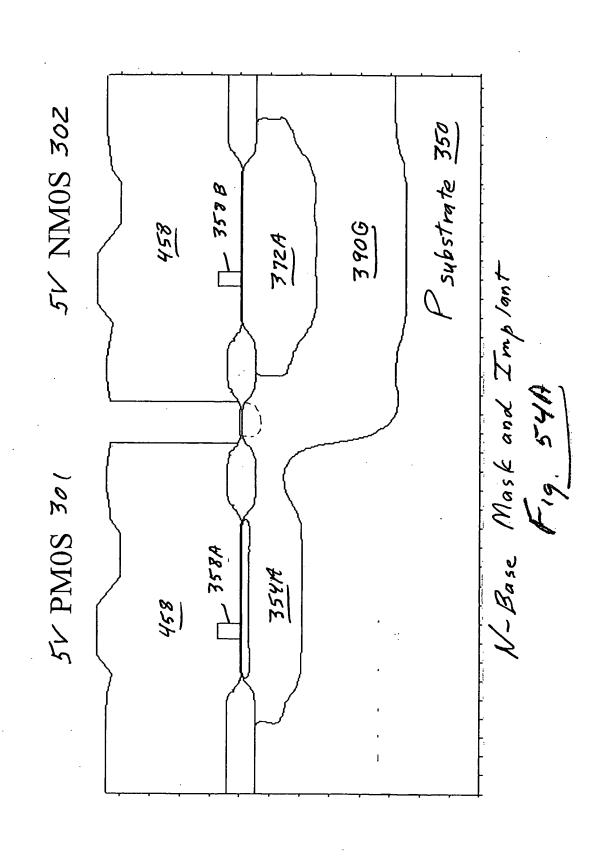


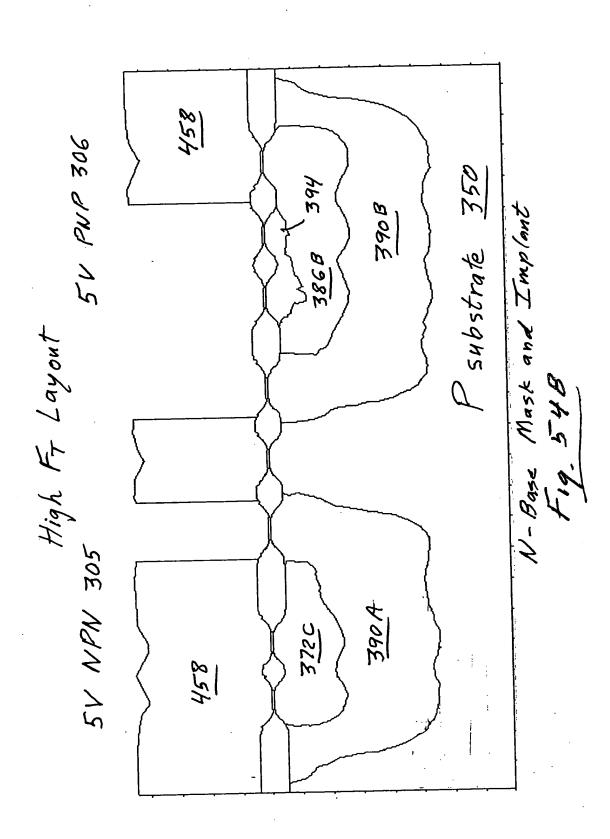
30V Lateral Trench DMOS 308

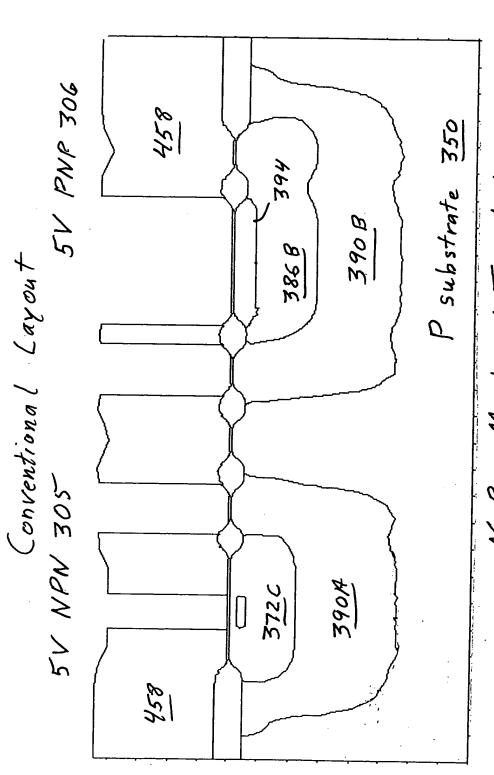




Planar Gate Formation

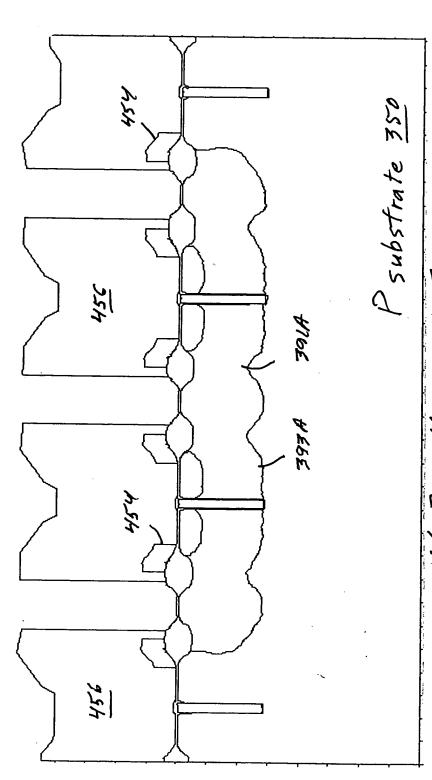




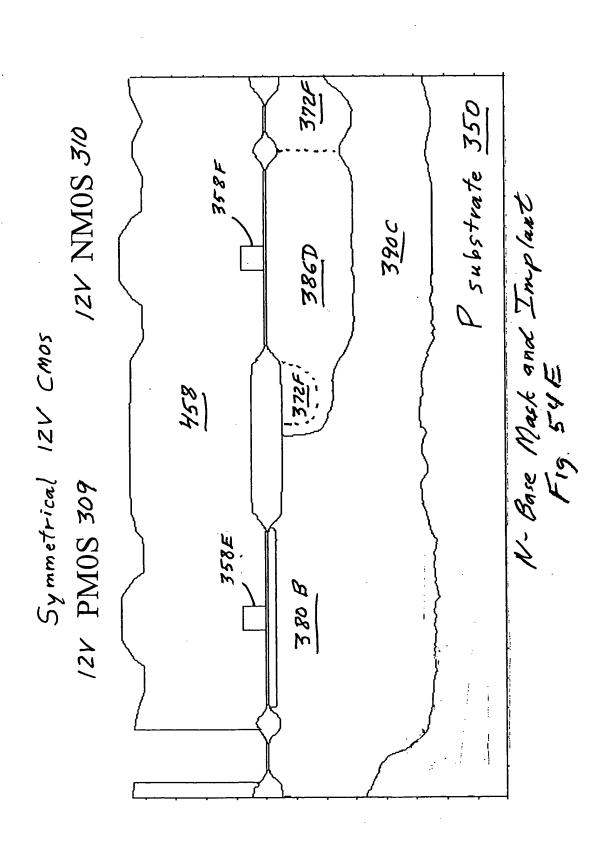


N-Base Mask and Implant Fig. 54C

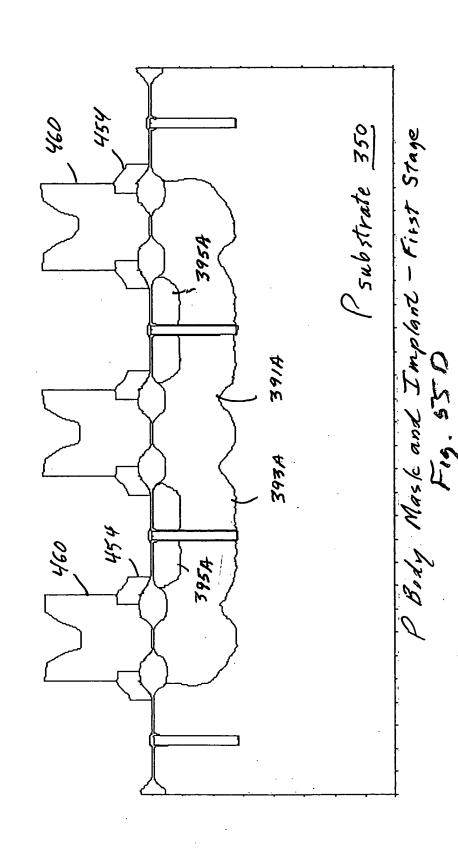
30V Lateral Trench DMVS 308



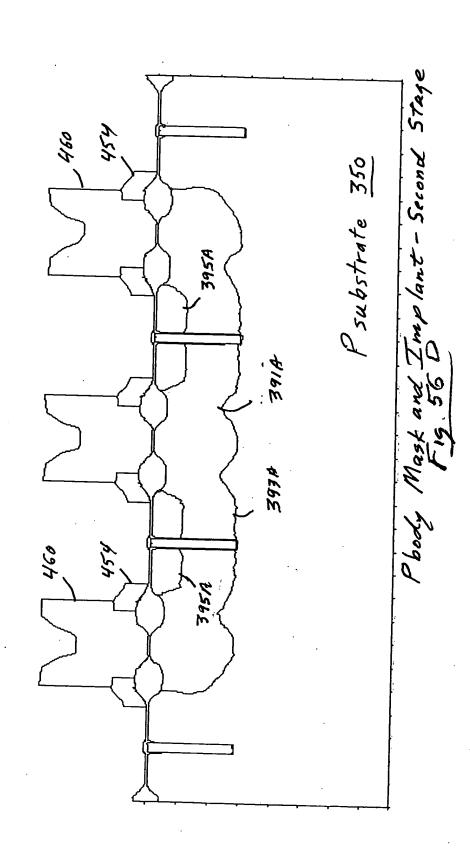
N-Base Mask and Implant Fig. 54D

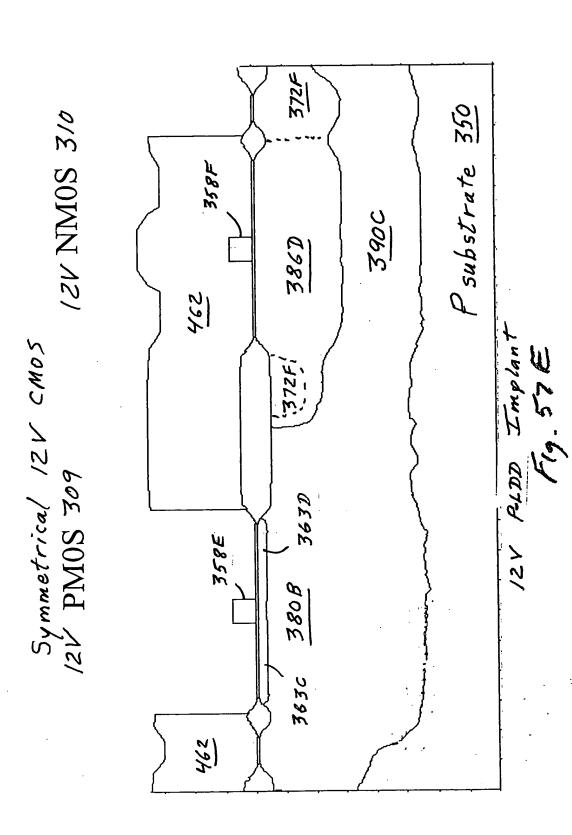


30V Lateral Trench DMOS 308

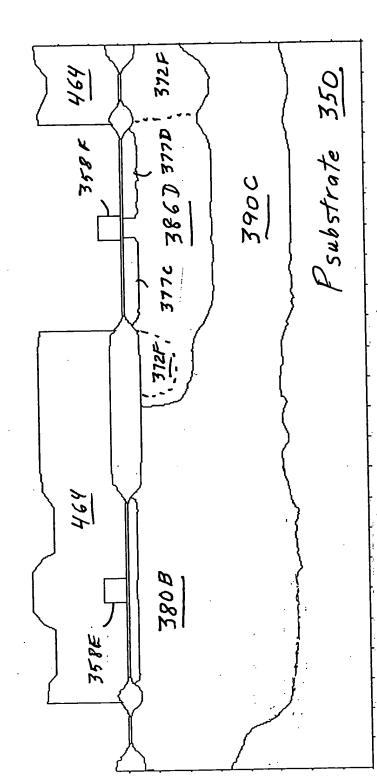


30V Lateral Trench DMOS 308

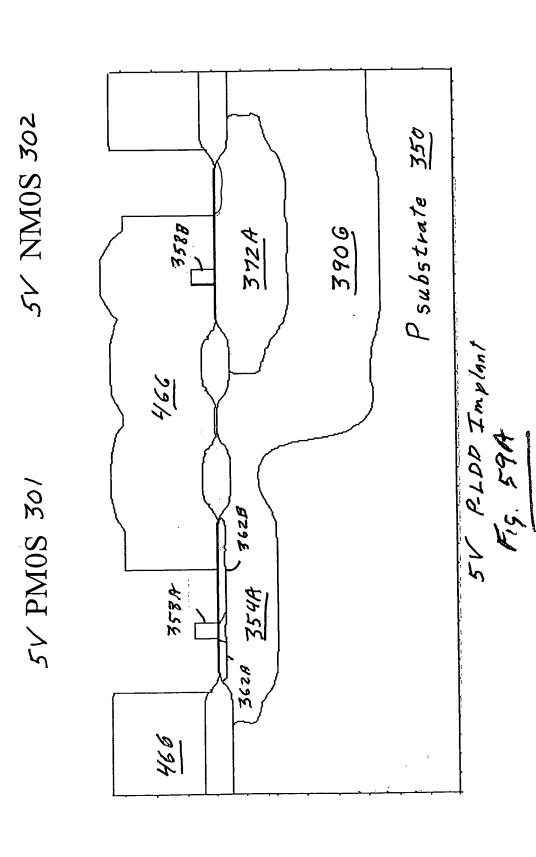




012 SOMN 721 Symmetrical 12V CMOS 12V PMOS 309



12 V N-LDD Implant Fig 58 E



5V PNP 306 P substrate 350 394 3808 3868 766 High F Layout 5V NPN 305 466 390A 3720

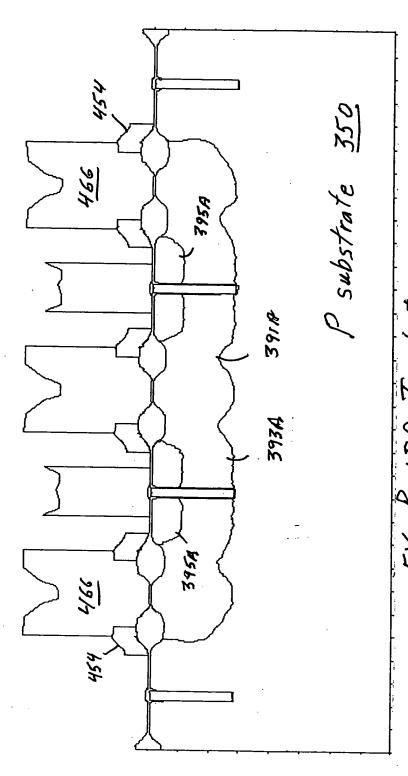
5V P-LOD Implant

486 Psubstrate 350 SV PNP 394 3908 3868 99/1 5V NPN 390A 3720 994

Conventional Layout

5V P-LOD Implant

30V Lateral Trench DMOS 308



5V 1-100 1m

A

5V NM0S 302

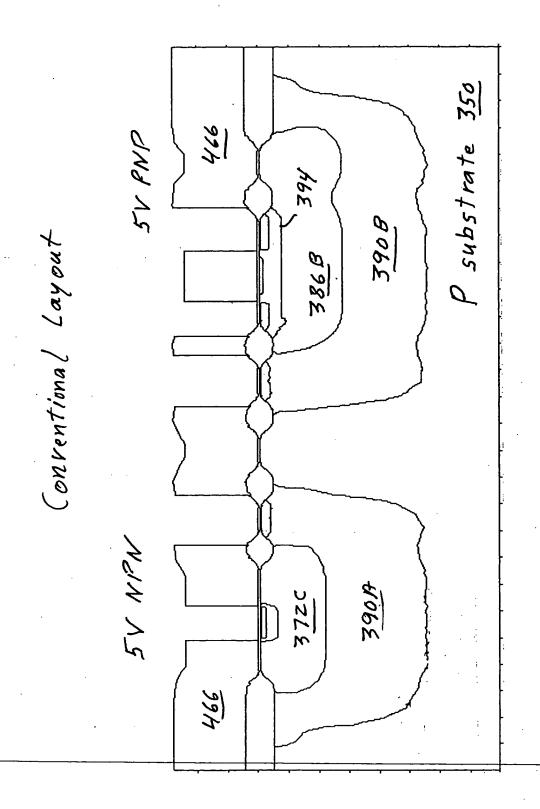
51 PM0S 301

P substrate 350 893 3768 340€ 3588 376A 372A 354A 3584 894

SV N-LDD Implant Fig 60A

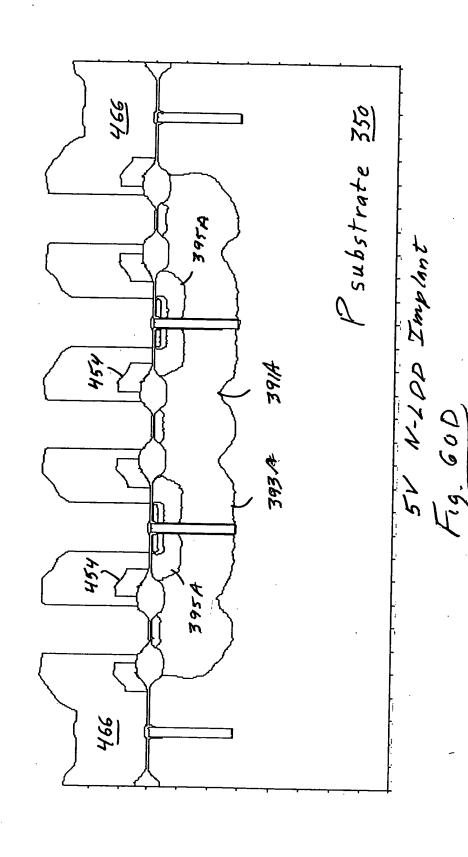
P substrate 350 5V PNP 306 468 344 390 13 £ 88 B High F Layout 5V NPN 305 390A 372C 894

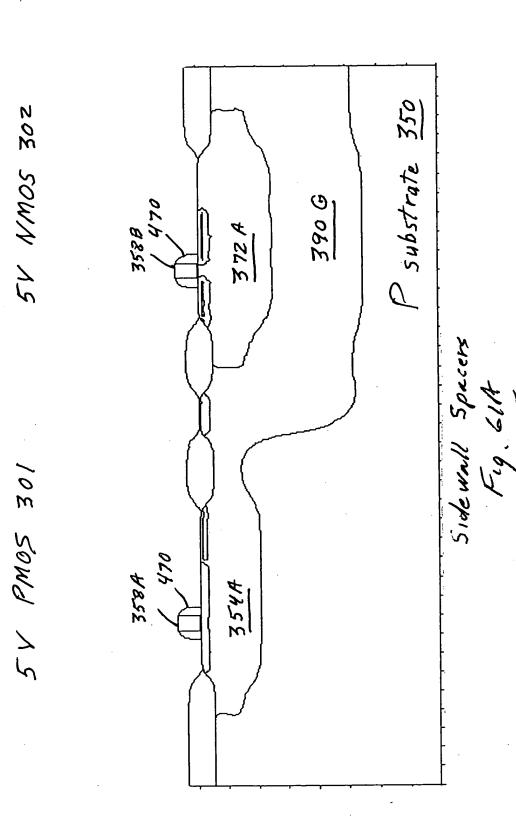
5V N-LOD Implant Fig 60B



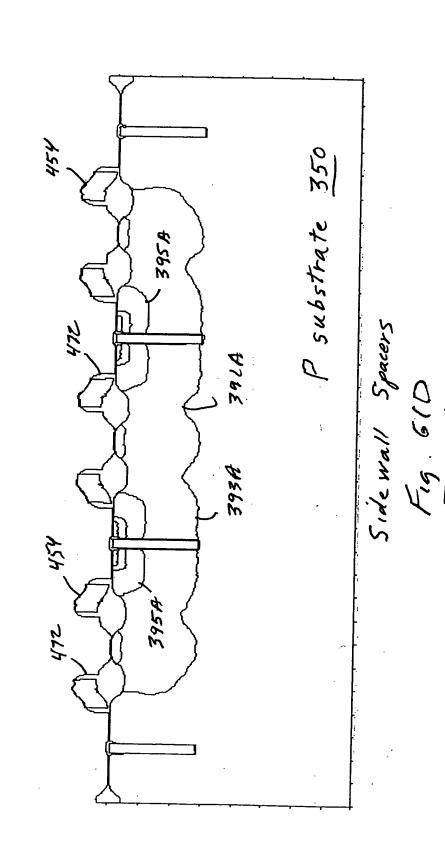
5V N-LOD Implant

30V Lateral Trench DMOS 308





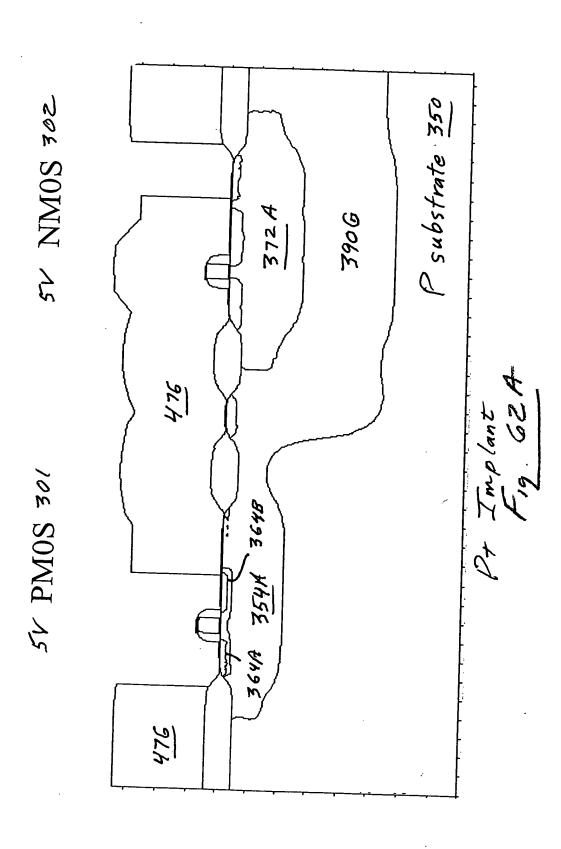
30V Lateral Trench DMOS 308



12× NMOS 310 Symmetrical 12V CMPS 121 PMOS 309

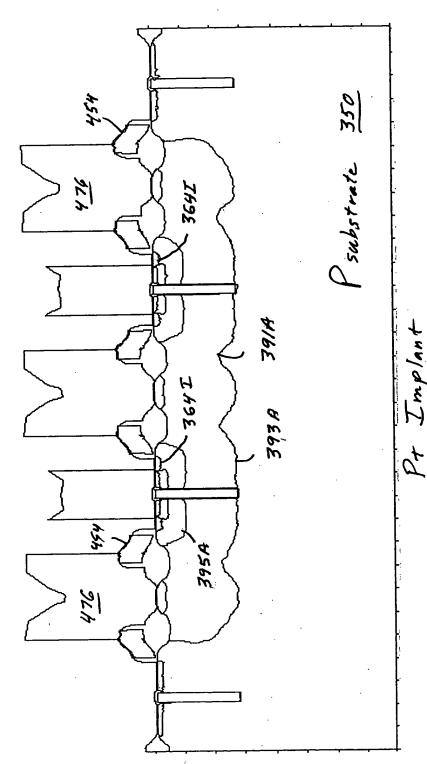
372F (Substrate 350 358F 474 390C 288 0 325F1 358E 474 , 380B

Sidewall Spacers



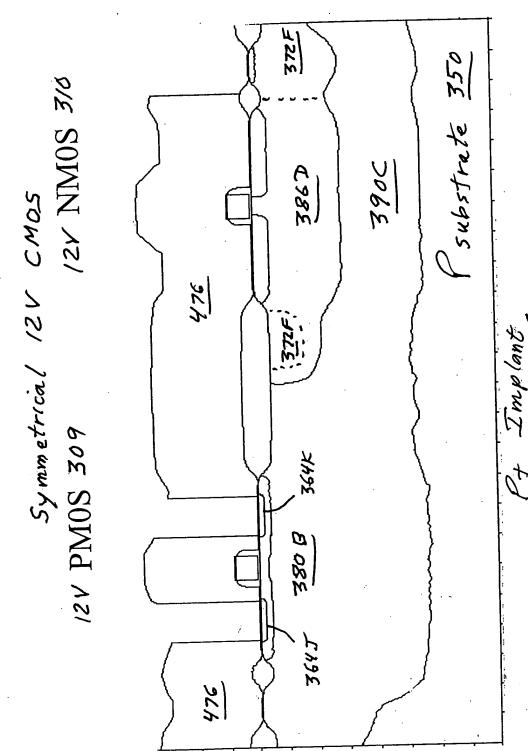
P substrate 350 5V PNP 306 364F 3646 38% 390 B 386 B 476 High Fy Layout P+ Implant F19.62B 5V NPN 305 92H 364E 390A 3726

P substrate 350 394 5 PNP 380 8 386 B Conventional Layout Pt Implant Fig 62C 92 h 5V NPN 390A 3726 <u>924</u>

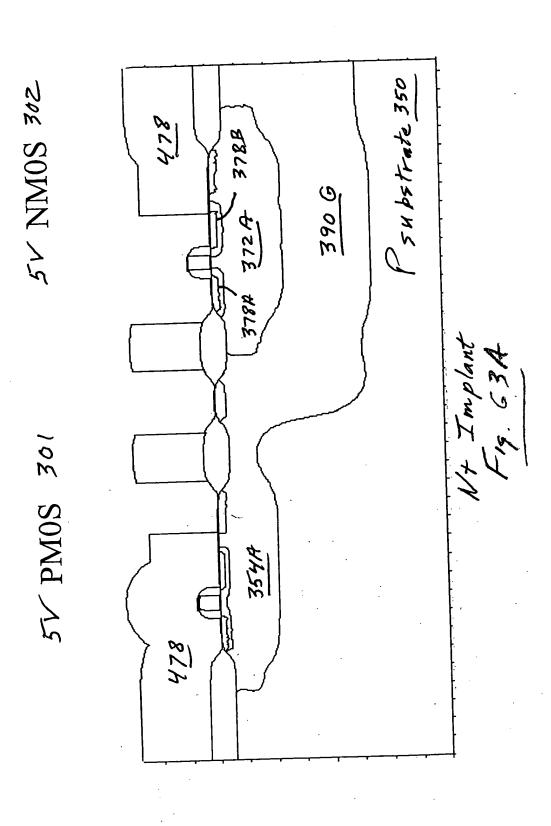


30V Lateral Trench DMG 308

Pt Implant Fig. 620



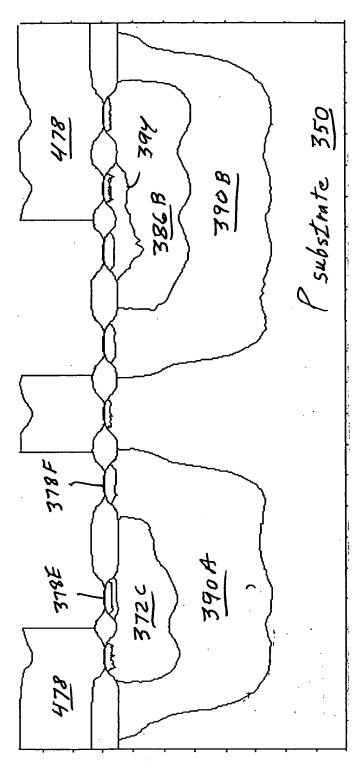
P+ Implant



High Fr Layout

5V NPN 305

5V PNP 306

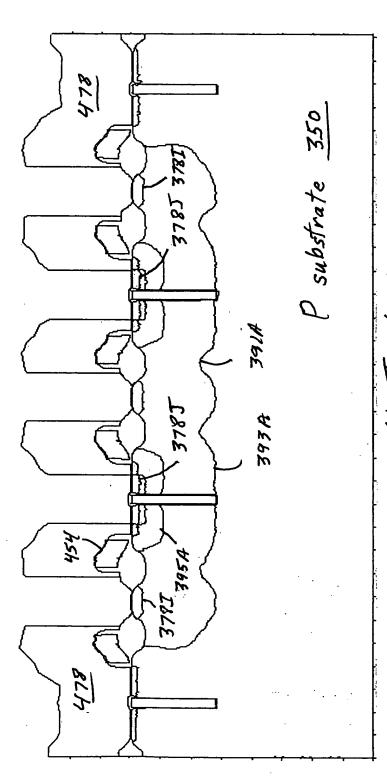


N+ Implant Fig. 638

824 SV PNP P substrate 350 398 3908 386B Conventional Layout 50 NPN 390 A 3726 470

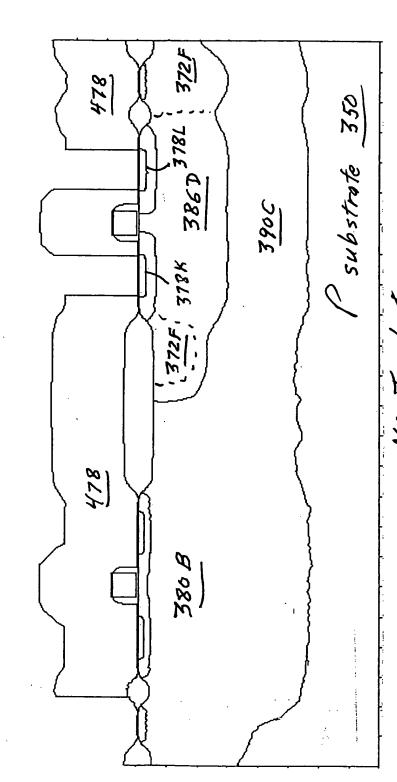
Nt Implant Fig. 63C

50V Lateral Trench DMOS 308

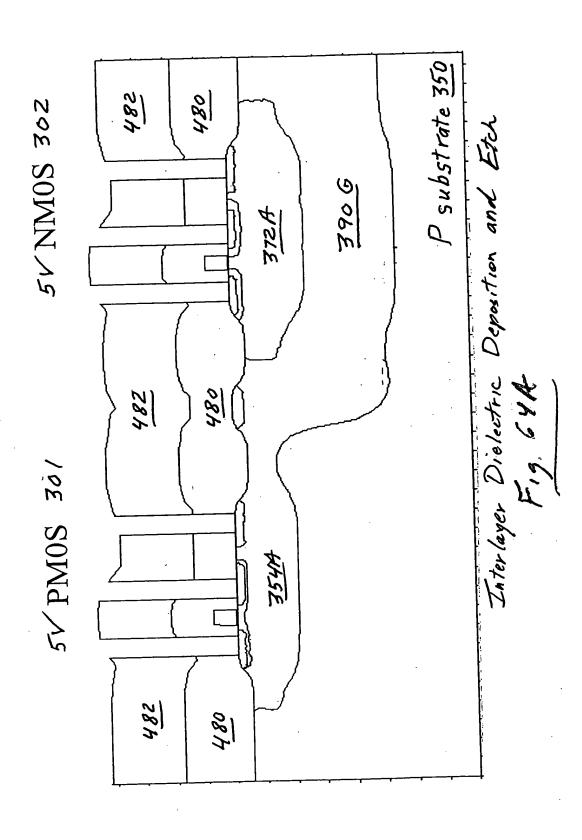


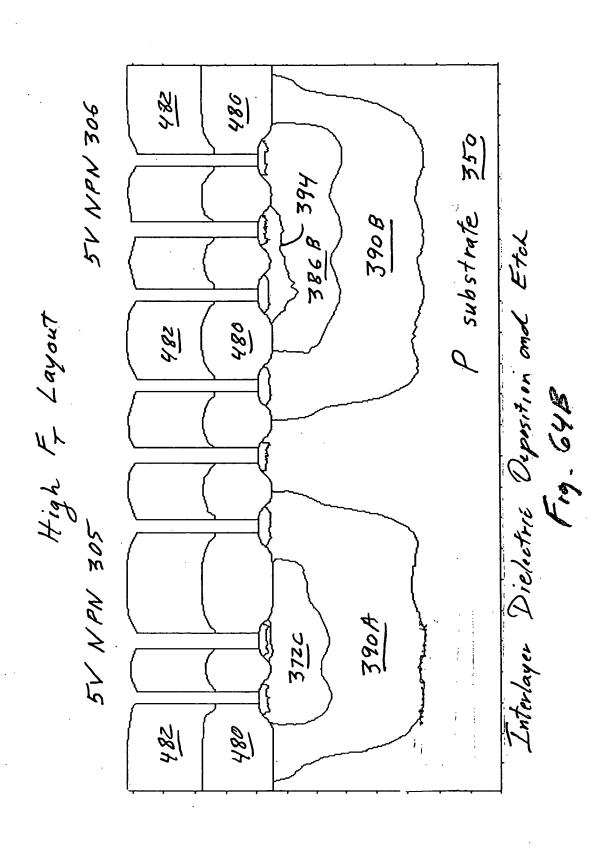
Nt Implant Fig 630

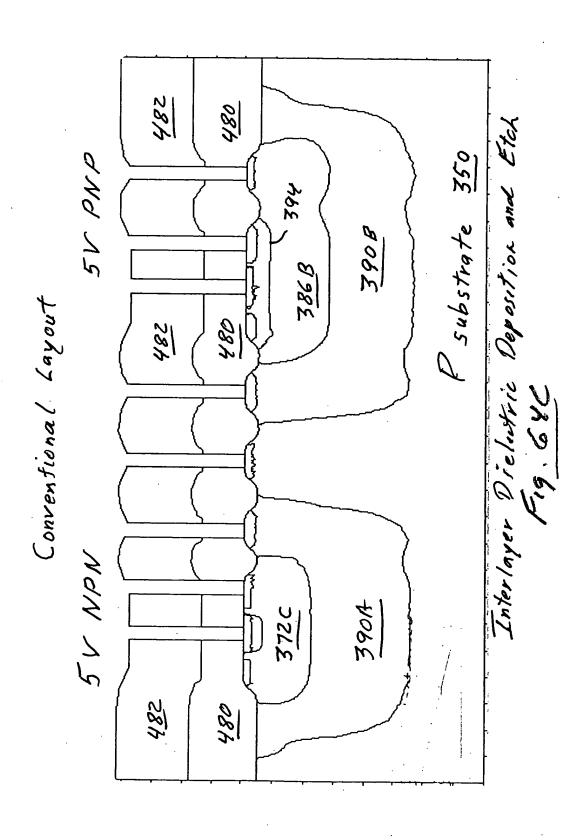
12V NM0S 310 Symmetrica (12V CMOS 12V PMOS 309 12



N+ Implant Fig 63E



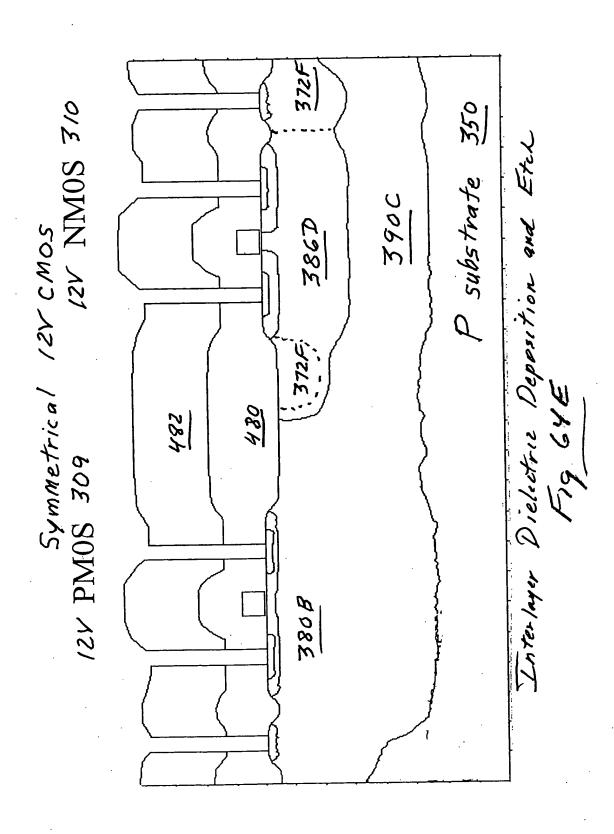


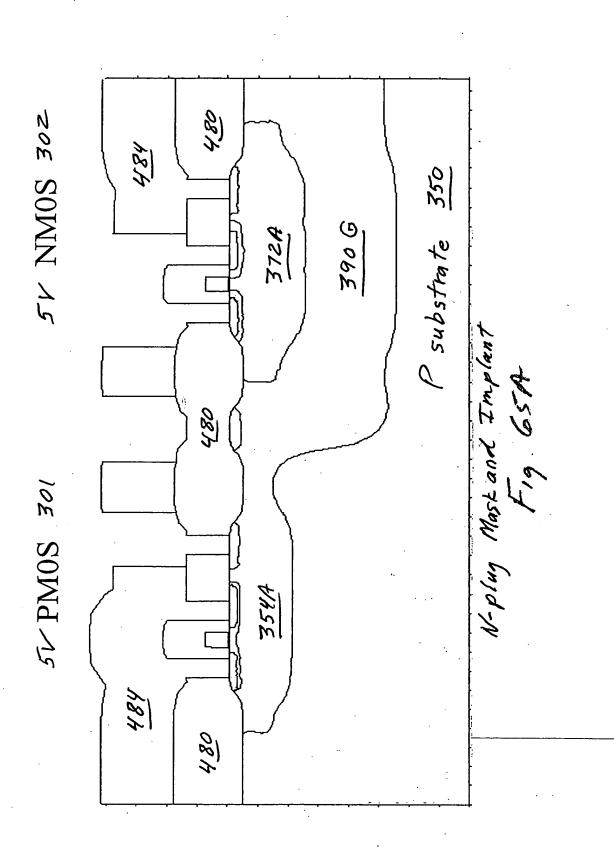


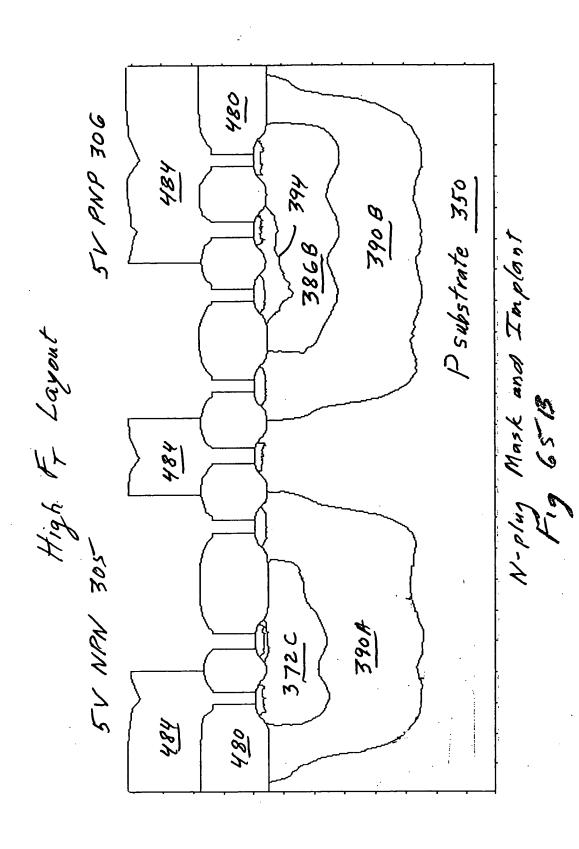
Psubstrate 350 30V Lateral Trench DMOS 308 480 482 3918 393A 3854 28/ 480

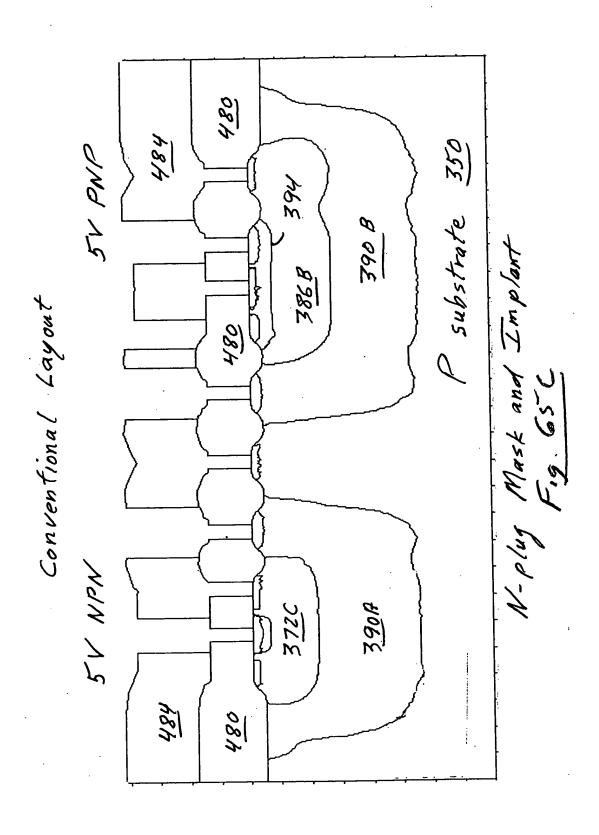
Interlayer Dielectric Deposition and

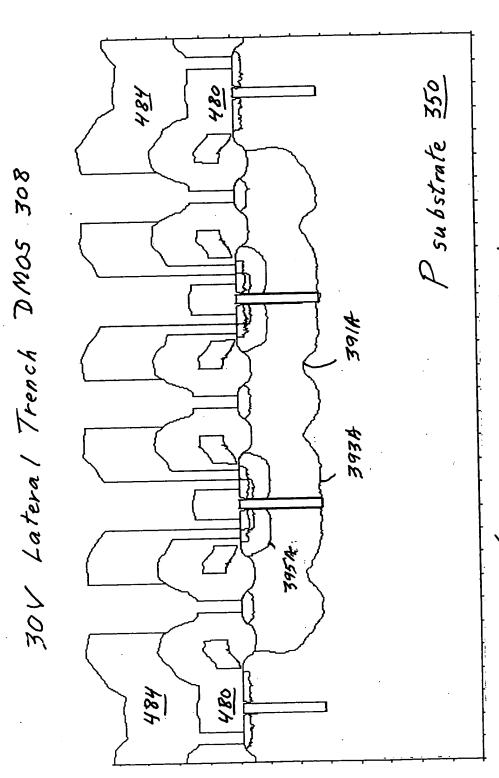
F19. 600



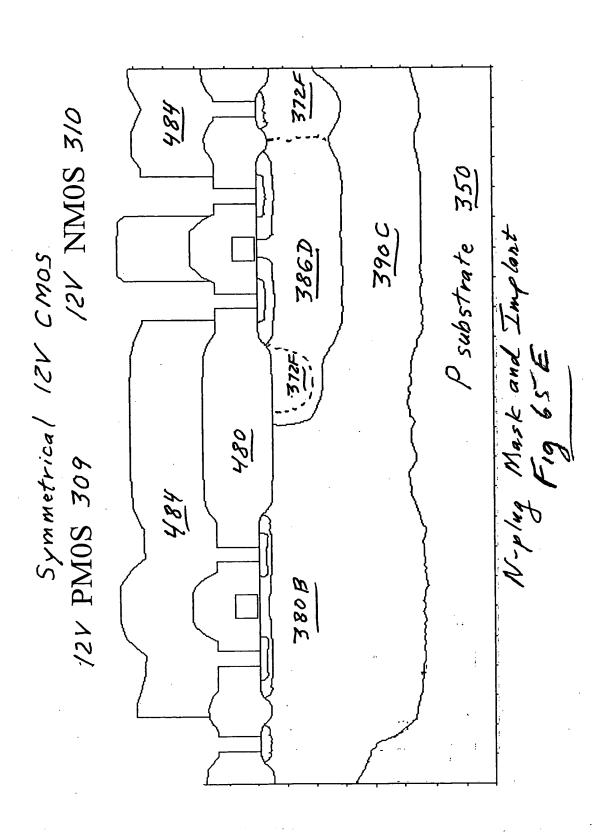




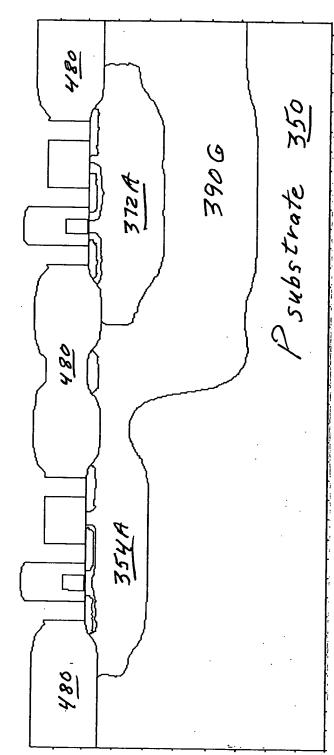




N-pluy Mask and Implant



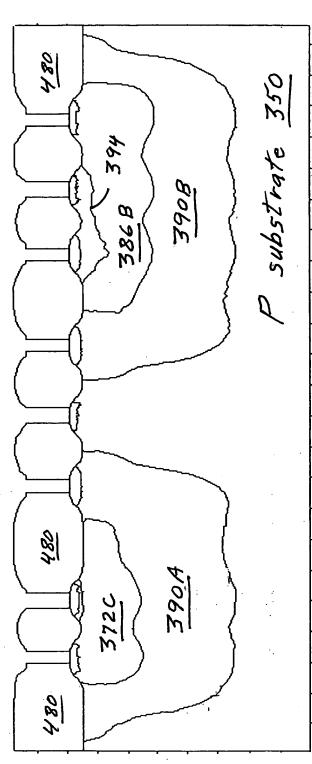
5V NM0S 302 5V PM0S 301



High F Layout

SOE NON 15

5V PNP 306

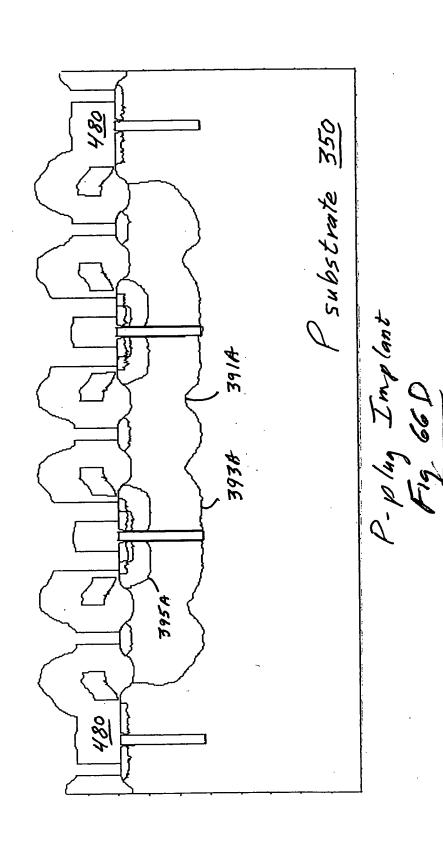


P-plug Implant Fig. 66 B

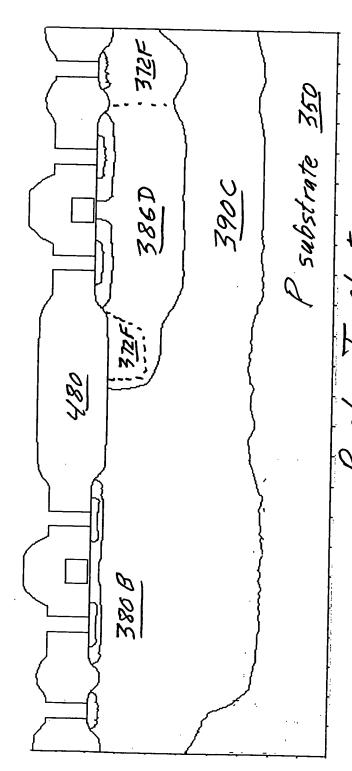
180 P substrate 350 SY PNP 394 340 8 3868 180 SVNPN 390A 312C 180

Conventional Layout

30VLatera (Trench DMOS 308

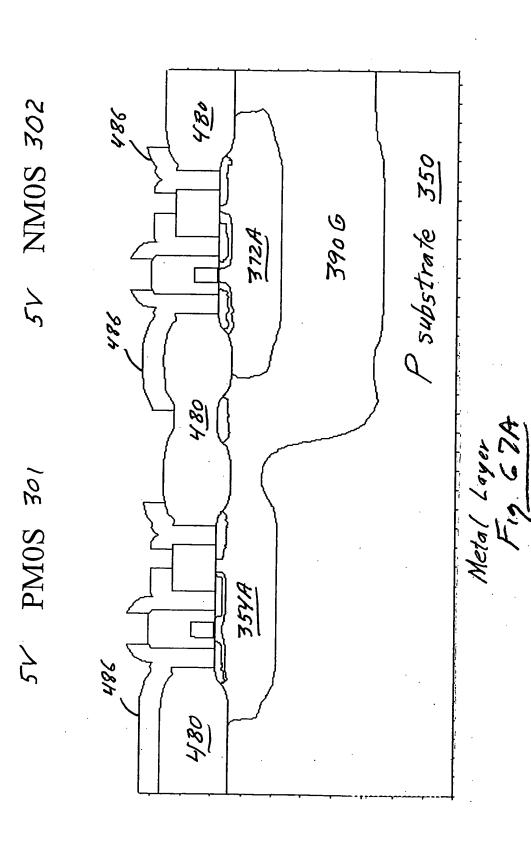


Symmetrical 12V cmos 12V PMOS 309 12V NMOS 310

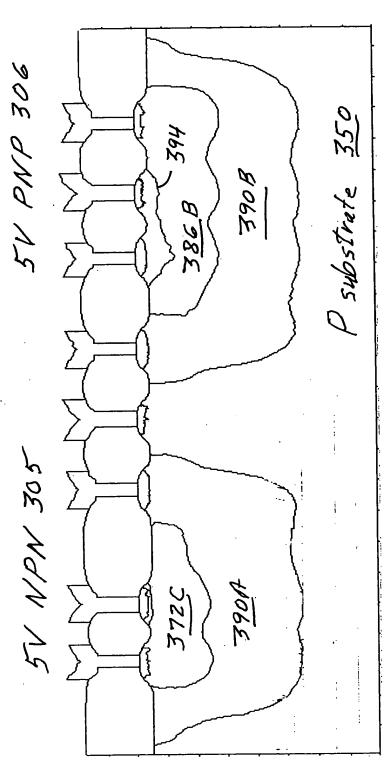


P-plug Implant

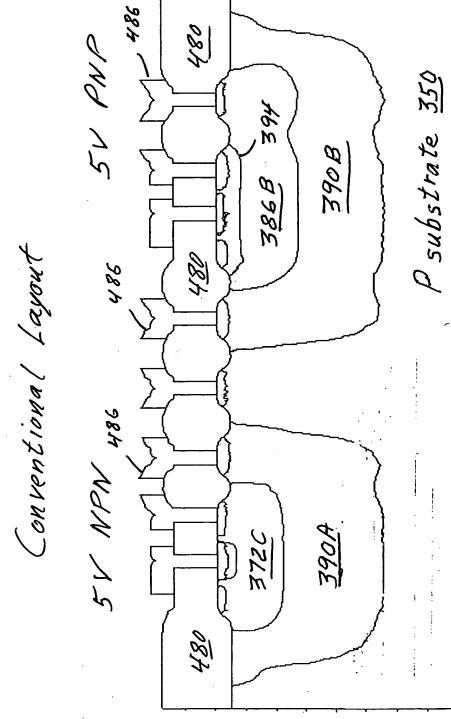
L19 66



High F Layout

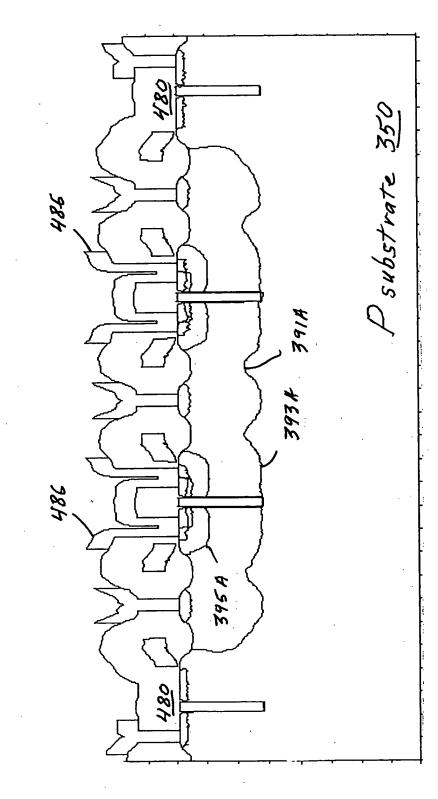


Metal Layer Fig. 67B

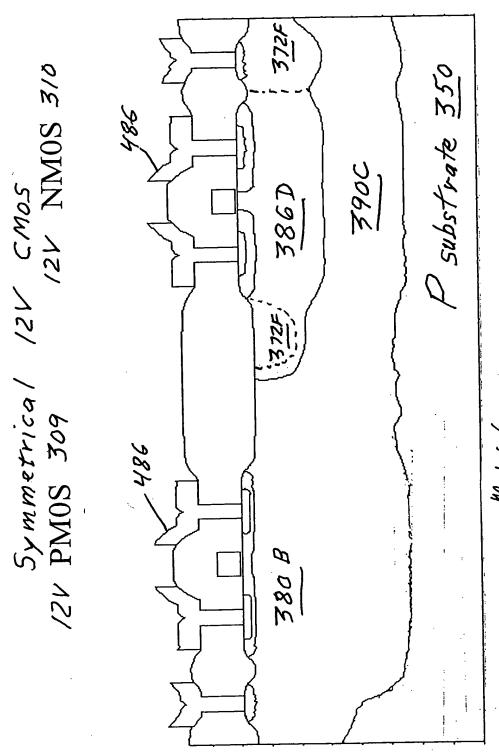


Metal Layer Fig. 67C

30V Lateral Trench DMOS 308



Metal Layer Flg. 670



Metal Layer

Fig. 17V

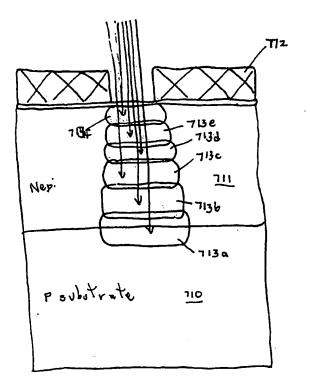


Fig. 17W

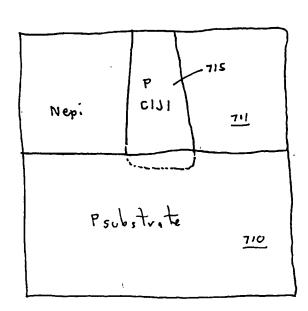
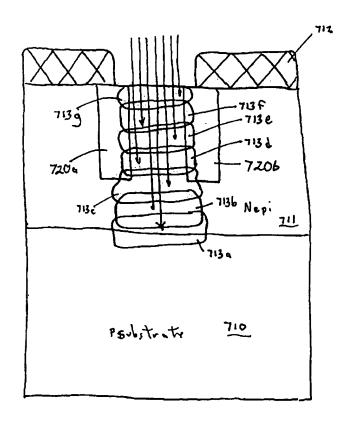


Fig. 17×

Fig. 174



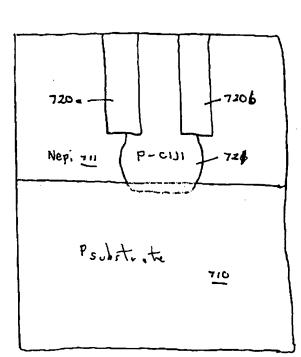


Fig. 172

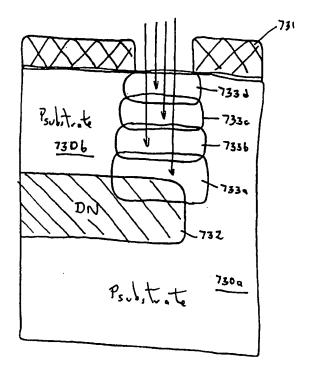


Fig. 17 AA

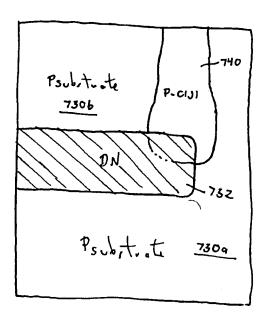


Fig. 1788

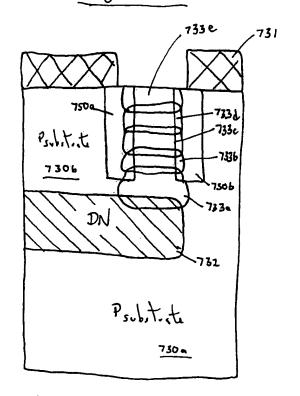


Fig. 17cc

